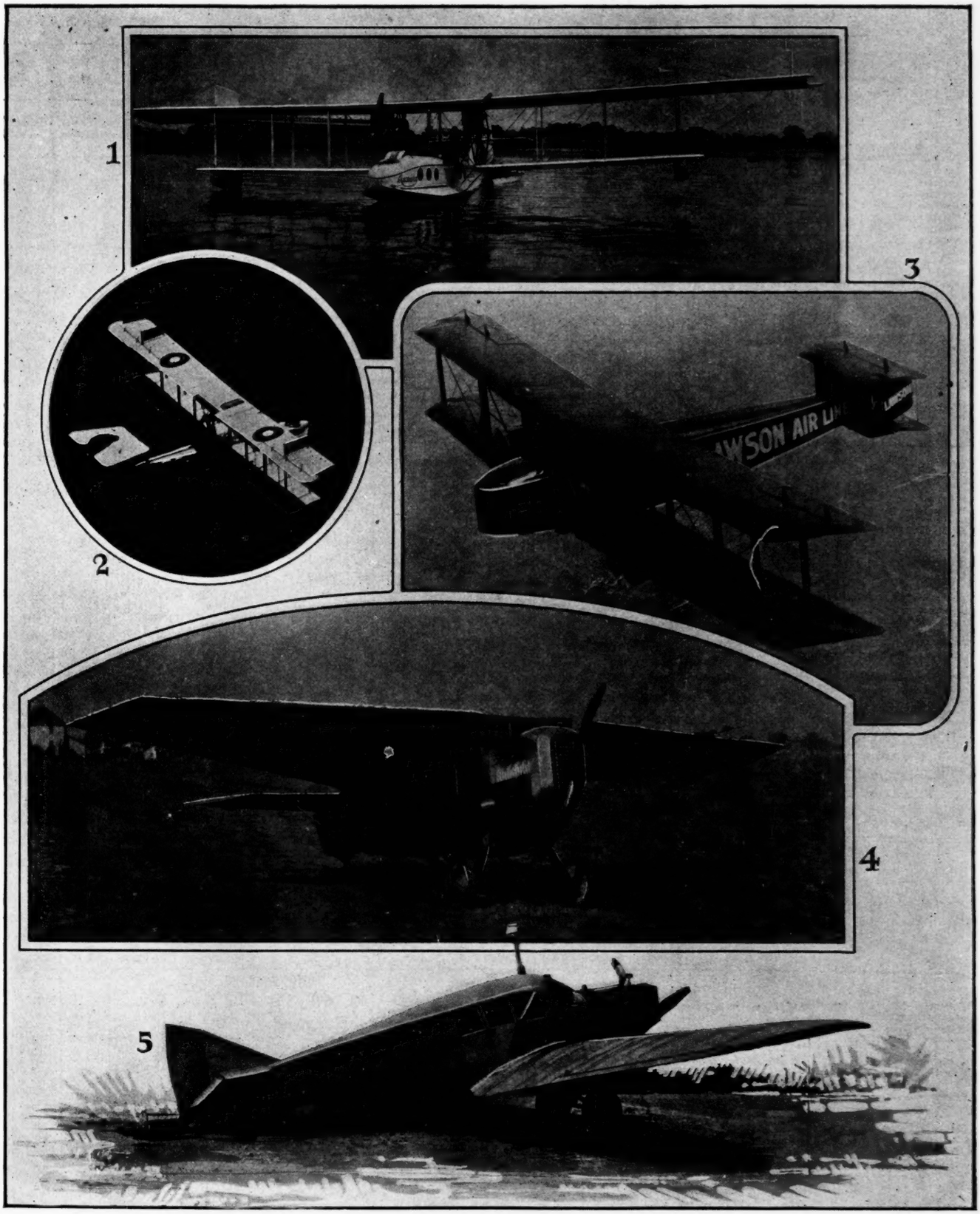
Types of American and Foreign Built Aircraft



1—The Aeromarine F5S Navy cruiser. 2—The Aeromarine HS2L commercial airplane.* 3—The Lawson Airliner.* 4—Stout batwing monoplane. 5—The Junker all-metal airplane*

**Photos supplied by Manufacturers' Aircraft Association.*

Specifications of Ameri

(Compiled for Automotive Indus

Manufacturer and Model	Type	Use	GENERAL: Over-all Dimensions Length, Ft.-In.	Height, Ft.-In.	Width, Ft.-In.	Crew and Pass.	POWERPLANT: Engines No.	Make	Total H.P.	Propellers No.	Blades	Diam., Ft.-In.	Pitch, Ft.-In.	WING AND TAIL DATA: Angle of Incidence Upper	Lower	Chord Upper, Ft.-In.	Lower, Ft.-In.	Span Upper, Ft.-In.	Lower, Ft.-In.
Aeromarine 40-U	PB Boat	P	28-11⅜	12- 7	48-6	2	1	Aeromarine, U-6D.	130	1	2	8- 2	4-6	3°-5′	2°	6- 3	6- 3	48-6	37- 6
Aeromarine 44-U	PB Boat	P	28-11⅜	12- 7	48-6	3	1	Aeromarine, U-6D.	130	1	2	8- 2	4-6	3°-5′	2°	6- 3	6- 3	48-6	37- 6
Aeromarine 50-U	PB Boat	P	28-11⅜	12- 7	48-6	3	1	Aeromarine, U-8D.	180	1	2	8- 2	4-6	4°-20′	3°-5′	6- 3	6- 3	48-6	37- 6
Aeromarine 60-U	PB Boat	P	31- 8⅝	12- 7	55-8⅛	5	2	Aeromarine, U-6D.	260	2	2	8- 2	4-6	3°-5′	2°	6- 3	6- 3	55-8⅛	.....
Aeromarine 50-S-2	PB Boat	P	28-11⅜	12- 7	48-6	3	1	Wright-Hispano.	180	1	2	8- 2	5-0	4°-20′	3°	6- 3	6- 3	48-6	37- 6
Aeromarine 75	TB Boat	C	49- 4	18- 9	103-6	12	2	Liberty, C	700	2	.....	.....	.....	4°	4°	8- 0	8- 0	103-9	74- 4
Boeing BBL-6	TB Land	P	29- 3⅝	10-10	44-9¼	3	1	Hall-Scott, L-6	200	1	2	8- 2	6-0	2°	2°	6- 6	6- 6	44-9¼	31-11¼
Curtiss Eagle-1-Engine	TB Land	C	37- 2⅝	12-11	64-4⅛	10	1	Liberty, A	400	1	2	10- 6	.....	.....	.....	7- 9	7- 9	64-4⅛	64- 4⅛
Curtiss Eagle-2-Engine	TB Land	C	37- 2⅝	12-11	64-4⅛	10	2	Curtiss, C-12	800	2	2	.....	.....	.....	.....	.....	.....	.....	.....
Curtiss Eagle-3-Engine	TB Land	C	37- 2⅝	12-11	64-4⅛	10	3	Curtiss, K-6	450	3	2	8- 2	.....	.....	.....	7- 9	7- 9	64-4⅛	64- 4⅛
Curtiss G.-B. Racer	TM Land	SP	.....	.....	27-0	1	1	Curtiss, C-12	400	1	.....	8- 0	.....	.....	None	4- 0	None	27-0	None
Curtiss MF-K-6	PB Boat	SP	.....	.....	49-9⅜	3	1	Curtiss	160	1	.....	8- 0	.....	.....	.....	5- 0	5- 0	49-9⅜	38- 7⅝
Curtiss Oriole L-72-7	TB Land	SP	.....	.....	40-9⅝	3	1	Curtiss	150	1	2	8- 0	.....	.....	.....	5- 4	5- 4	40-9⅝	40- 9⅝
Dayton-Wright K-T	TB Land	SP	30- 1⅝	11- 2½	43-7½	3	1	Liberty, A	420	1	.....	.....	.....	3°	3°	5- 6	5- 6	43-7½	43- 7½
Dayton-Wright O-W	TB Land	SP	46- 0	9- 0	28-6	3	1	Wright, E-2	180	1	.....	.....	.....	3°	3°	6- 6	6- 6	46-0	46- 0
Dayton-Wright R-B	TM Land	SP	22- 8	8- 0	21-2	1	1	Hall-Scott	250	1	2	.....	.....	1°	None	6-6 to 4-0	None	21-2	None
Gallaudet C-3-2	TB Land	C	29- 5	10- 2	45-0	5	1	Liberty, A	420	1	2	9- 2	.....	2°	2°	7- 0	7- 0	45-1½	45- 0
Gallaudet D-4	PB Seaplane	F	27- 5	36- 0	46-4⅝	2	1	Liberty, A	420	1	3	9- 1½	8- 2	.....	.....	7- 0	7- 0	46-4⅝	45- 0
Gallaudet EL-2	TM Land	SP	18- 7	5- 6	33-0	2	1	Lawrance	60	1	3	5- 8	4- 6	2°	None	4- 6	None	33-0	None
Huff, Daland HD-1	TB Land	C	22- 0	8- 9	37-0	2	2	Le Rhone	160	2	2	7- 0	.....	2°	2°	6- 0	4- 0	37-0	36- 4
Huff, Daland HD-4	TB Land	T	22- 0	8- 9	36-0	2	1	ABC, Wasp	150	1	2	9- 0	.....	2°	2°	6- 0	4- 0	36-0	36- 0
Kinner Airster	TB Land	SP	20- 0	7- 9	26-6	2	1	Kinner	60	1	2	7- 0	5-0	2°	2°	4- 0	4- 0	26-6	26- 6
Laird Swallow	TB Land	SP	23- 4	8- 8	36-0	3	1	Curtiss, OX-5	90	1	2	.....	.....	.....	.....	4-10	4-10	36-0	36- 0
L-W-F H (Owl)	TB Land	B	53- 9½	17- 6	105-0	3*	3	Liberty, A	1200	3	2	9- 6	.....	4½°	3½°	11- 0	11- 0	105-0	105- 0
L-W-F J-2	TB Land	M	31- 2	11- 0	56-9¾	1†	2	Hall-Scott, L-6	400	2	2	8- 6	6-6	3°	3°	5- 6	5- 6	56-9¾	56- 9¾
Glenn L. Martin MB-2	TB Land	B or C	43- 7⅝	15- 6¾	74-2	4	2	Liberty, A	800	2	2	10- 0	6-0	2°	2°	7-11	7-11	74-2	74- 2
Glenn L. Martin MB-T	TB Land	B or TP	46- 4	14- 0	71-5	4	2	Liberty	800	2	2	9-10	6-3½	2°	2°	7-11	7-11	71-5	71- 5
Glenn L. Martin MT	TB Land	TP	45- 8	15- 6	71-5	4	2	Liberty	800	2	2	9-10	6-1	2°	2°	7-11	7-11	71-5	71- 5
Nebraska L-S Cabin Cruiser	TB Land	SP	26- 4	.....	41-0	4	1	Hispano-Suiza	220	1	2	.....	.....	2½°	2½°	6- 0	6- 0	26-4	26- 4
Nebraska L-S Speedster	TB Land	SP	25- 8	10- 0	32-0	3	1	Hispano-Suiza	180	1	2	8- 3	6-6	3°	1½°	6- 0	6- 0	32-0	32- 0
Orenco D	TB Land	S	21- 6	8- 3	30-0	1	1	Wright	300	1	2	8- 8	.....	1¾° or 2°	1¾° or 1½°	5- 0	5- 0	30-0	28- 0
Orenco F (Tourister)	Biplane Land	P	24-10	9- 0	38-0	4	1	Wright	150	1	.....	.....	.....	2°	2°	5- 0	5- 0	38-0	38- 0
Pacific Pacific Hawk	TB Land	C	32- 0	10- 8	52-0	6	2	Curtiss, OX-5	360	2	2	8- 4	5-6	4°	4°	6- 6	6- 6	52-0	52- 0
Sperry Amphib.-Triplane	PT Amph	.....	31- 6	15- 4	48-0	3	1	Liberty, C	369	1	4	.....	.....	All 4°		All 5-0		All 48-0	
Sperry Messenger	TB Land	MS	17- 9	7- 0	20-0	1	1	Lawrence	60	1	2	.....	.....	.....	.....	4- 0	4- 0	20-0	20- 0
Stout SM-20	TM Land	C	24- 0	8- 8	36-0	3	1	Packard, 744	200	1	2	8- 8	6-4¼	3°	None	10-0 Mean	None	36-0	None
Stinson Greyhound	TB Land	SP	22- 4	9- 0	34-2¼	.....	1	Curtiss, OX-5	90	1	2	.....	.....	.....	.....	5- 0	5- 0	34-2¼	34- 2¼
Thomas-Morse. 2-Engine-Mail	TPB Land	M	25- 5	11- 0	45-6	2	2	Wright	600	2	2	9- 2	.....	+⅛°	−⅛°	8-10	8-10	45-6	45- 6
U. S. Air Service VCPR	TB Land	S	24- 2	8- 8	28-2	1	1	Packard	638	1	2	9- 0	.....	.....	.....	3-6 to 6-0	3-6 to 5-7	27-6	26- 2
Waterman 3-L-400	TB Land	C	27- 6	11- 2	43-6	3	1	Liberty	400	1	2	9- 8	7-8	1°	1°	5- 6	5- 6	43-6	43- 6
West Virginia. Louis Bennett, Jr.	TB Land	SP	27- 0	9- 9	44-5½	3	1	Hispano-Suiza	150	1	2	.....	.....	2°	2°	6- 0	6- 0	44-5½	34-10

*Also bomb load. †Also 650 lbs. mail.

For abbreviations see pages 368 and 369.

Specifications of

Manufacturer and Model	Type	Use	GENERAL: Over-all Dimensions Length, Ft.-In.	Height, Ft.-In.	Width, Ft.-In.	Crew and Pass.	POWERPLANT: Engines No.	Make	Total H.P.	WING AND TAIL DATA: Angle of Incidence Upper	Lower	Chord Upper, Ft.-In.	Lower, Ft.-In.	Span Upper, Ft.-In.	Lower, Ft.-In.
Albatross—L-47	TB Land	M	24- 6	10-10	38- 7	2	1	Mercedes	180	....	....	....	....	38- 7	....
Dornier—Commercial	1P 1TM Boat	C	49- 6	....	92- 5	8 11	2	Maybach	520	....	....	....	....	92- 5	....
Dornier—R-I	PB Boat	C	95- 9	23- 9	143- 6	..	3	Maybach	720	....	....	15- 2	11-10	143- 6	....
Dornier—R-II	TP1½ PL Boat	C	70-10	25- 0	109- 6	..	4	Maybach	960	....	....	21- 4	11- 9	109- 6	....
Dornier—R-III	TPM Boat	C	75- 0	26- 9	122- 0	..	4	Maybach	1040	....	....	21- 4	....	122- 0	....
Dornier—R-IV	TPM Boat	C	73- 0	28- 0	121- 4	20	4	Maybach	1080	....	....	21- 4	....	121- 4	....
Fokker—D-VIII	TM Land	F	19- 5	9- 4	27- 6	1	1	Oberursel	140	....	....	....	....	27- 6	....
Fokker—F-IV	TM Land	C	....	12- 0	56- 3	12	1	B. M. W	185	....	....	....	....	56- 3	....
Fokker—V-36	TB Land	F	21- 4	10- 1	29- 6	1	1	B. M. W	185	....	....	....	....	29- 6	....
Fokker—V-45	TM Land	P	37- 0	....	42-10	6	1	B. M. W	185	....	....	10- 3	....	42-10	....
Gotha—G-VII	TB Land	C	31- 7	11- 6	65- 1	..	2	Maybach	520	....	....	....	....	65- 1	....
Gotha—G-VIII	TB Land	C	32- 2	11- 7	71- 4	..	2	Maybach	520	....	....	....	....	71- 4	....
H. A. W. A—F-VI	TB Land	SP	22-11	....	34- 5	2	1	B. M. W	185	....	....	5- 3	4- 5	34- 5	....
H. A. W. A—F-X	TT Land	SP	26-10	....	37-10	6	1	Benz	230	....	....	5-7 3-11	U. & L. Center	32-9 37-10	U. & C Lower
Junkers—D-I	TM Land	F	22- 0	9- 5	29- 2	1	1	Mercedes	180	....	....	5-11½	....	29- 2	....
Junkers—J-I	TB Land	TF	29- 6	11- 9	55- 0	2	1	Benz	230	3°	3°	8-1 to 6-10	4-10	55- 0	35- 7
Junkers—JL-6	TM Land	P	31- 6	10- 2	48- 6	8	1	B. M. W	185	....	....	....	....	48- 6	....
Pfalz—DR-I	TT Land	S	18- 1	9- 1	28- 0	3	1	Siemens	160	4 to 0	3	3- 7	2- 4	28- 0	25- 7
Rumpler—5a	TB Land	C	25- 8	10- 1	40- 0	3	1	Mercedes	160	5.7 to .5	5.7 to .5	5- 6	5- 6	40- 0	40- 0
Sablatnig—KE-1	TM Land	SP	17- 5	7- 3	27- 6	1	1	Rheinische	20	....	....	....	....	27- 6	....
Zeppelin—Lindau CL-I	TB Land	F	....	9- 1	34- 5	2	1	Mercedes	160	3.7°	1.5° to 2°	4- 8	4- 8	34- 5	28-10
Zeppelin—Staaker	TM Land	C	54- 7	13- 6	102- 0	22	4	Maybach	1040	....	....	....	....	102- 0	....

can Airplanes, 1920-1921.

tries by Arch. & Don R. Black.)

WING AND TAIL DATA										WEIGHT IN LBS.					PERFORMANCE								
Areas in Square Feet							Gap Ft.-In.	Stagger In.	Sweep-back	Dihedral	Empty	Gas and Oil	Useful Load	Total Gross	Useful % Gross	Lbs. H.P.	Lbs. Sq. Ft.	High Speed		Low Speed M.P.H.	Climb		Service or Approx. Ceiling (Feet)	Range at High Speed (Miles)
Wings Total	Ailerons	Stabilizer	Elevators	Vert. Fin	Rudder	Non-skid Planes												M.P.H.	Alt. Feet		Mins.	Feet		
504	58.0	39.0	25.6	15.0	17.5	None...	6- 6	8	None...	2°	2,161	278	638	2,799	22.8	21.5	5.55	76.0	0	44.0	10	2,400	.....	200
504	58.0	39.0	25.6	15.0	17.5	None...	6- 6	8	None...	2°	2,245	282	821	3,067	26.8	23.6	6.1	73.5	0	50.0	10	2,500	.....	200
504	58.0	39.0	25.6	15.0	17.5	None...	6- 6	12	None...	2°	2,240	391	931	3,275	28.4	18.2	6.5	87.8	0	52.2	10	3,500	3,000	200
584	58.0	39.0	27.0	15.0	17.5	None...	6- 6	8	None...	2°	2,750	600	1,500	4,250	35.3	11.8	7.3	76.0	0	49.0	10	3,000	.....	200
504	58.0	39.0	25.6	15.0	17.5	None...	6- 6	12	None...	2°	2,240	391	931	3,275	28.4	18.2	6.5	87.8	0	52.2	10	3,500	.....	300
1,397	119.0	120.9	55.3	34.7	33.5	31.1	8-10½	None...	None...	1½°	8,456	1,587	4,367	12,823	34.0	18.3	9.2	85.0	0	50.0	.....	.....	.....	340
434	50.0	25.3	23.3	6.0	9.5	None...	6- 9	None...	None...	0° up 3° low	1,800	445	1,000	2,800	35.7	14.0	6.5	100.0	200	40.0	10	6,000	17,000	330
937	71.0	50.0	32.0	12.7	25.5	None...	7- 9	None...	None...	None...	4,245	1,580	3,180	7,425	42.8	18.5	7.9	100.0	.....	.....	10	2,600	10,000	.....
.....	.....	.....	.....	.....	.....	None...	.....	None...	None...	None...	5,310	1,780	3,380	8,890	38.4	11.1	.....	124.5	0	56.2	.....	.....	.....	.....
937	71.0	50.0	32.0	12.7	25.5	None...	7- 9	None...	None...	None...	5,150	1,080	2,690	7,840	34.3	17.4	8.38	101.5	.....	.....	30½	10,000	12,300	.....
190	.....	.....	.....	.....	.....	None...	None...	None...	None...	None...	1,745	240	455	2,200	20.7	5.5	24.4	.....	.....	.....	.....	.....	.....	.....
400	44.9	33.4	30.3	15.7	20.4	.....	6- 4⅛	None...	None...	0° up 2° low	1,911	289	815	2,726	29.9	17.0	6.82	76.5	0	.....	10	3,000	7,900	.....
403	48.9	19.9	21.8	5.5	11.9	None...	5- 6⅛	9½	None...	0° up 1½° low	1,695	.....	806	2,501	32.3	16.6	6.2	96.0	.....	.....	10	10,000	13,275	.....
441	71.6	38.4	24.0	6.0	13.5	None...	5-10	11¾	None...	3°	2,686	869	1,442	4,128	35.0	9.8	9.3	120.0	0	55.0	10	10,000	.....	720
534	62.0	40.0	22.8	.....	15.6	None...	5- 6⅞	None...	None...	None...	1,450	474	1,042	2,492	41.9	13.8	4.66	100.0	.....	35.0	10	6,000	.....	540
103	23.0	14.6	9.6	3.0	7.1	None...	None...	None...	.....	.....	1,400	.....	450	1,850	24.3	7.4	17.6	.....	.....	64.0	.....	.....	15,000	.....
580	58.0	38.5	24.0	6.0	13.5	None...	6- 0	10⅝	None...	2°	2,770	900	2,000	4,770	42.0	11.3	8.22	125.0	0	45.0	15	10,000	17,600	500
620	46.0	37.6	30.2	.....	17.2	.....	7- 0	17.2	.....	None...	3,800	650	1,600	5,400	29.6	12.8	8.7	124.5	0	46.0	2	2,100	15,000	.....
128	13.0	15.0	11.0	2.3	4.3	None...	None...	None...	None...	1°	725	50	400	1,125	35.5	16.0	8.75	85.0	0	45.0	25	6,000	9,000	100
347	44.0	21.0	20.0	6.2	16.0	None...	4- 9	17.0	None...	0° up 2½° low	1,495	225	775	2,270	34.1	14.2	6.5	100.0	0	50.0	20	10,000	16,000	200
328	44.0	21.0	20.0	6.2	9.0	None...	4- 9	17.0	None...	0° up 2½° low	1,273	221	627	1,850	33.0	12.6	5.6	95.0	0	40.0	10	10,000	16,000	271
208	30.0	16.0	18.0	3.0	7.0	None...	4- 6	9	None...	2½°	600	64	400	1,000	40.0	16.6	4.7	75.0	0	35.0	10	4,000	12,000	130
324	.....	.....	.....	.....	.....	None...	4-10	10	None...	1½°	1,075	195	675	1,750	38.6	19.4	5.4	86.0	0	38.0	10	4,000	.....	.....
2,200	200.0	174.4	83.2	28.0	78.9	None...	11- 0	None...	None...	0° up 2° low	12,400	3,720	7,600	20,000	38.0	16.6	9.1	110.0	0	55.0	9	6,000	17,500	1,100
604	70.6	38.4	24.0	6.8	20.0	None...	5- 8	None...	None...	3°	3,787	.....	1,763	5,550	31.7	13.9	9.18	105.0	0	53.0	5	4,500	18,000	.....
1,121	130.0	63.3	43.0	18.0	39.5	None...	8- 6	None...	None...	0° up 2° low	7,325	1,965	4,750	12,075	39.3	15.0	10.7	100.0	0	60.0	10	5,200	15,200	450
1,080	130.0	63.3	43.0	18.0	33.0	None...	8- 6	None...	None...	None...	6,449	1,085	3,683	10,123	36.5	12.6	9.38	118.0	0	56.0	10	6,000	16,400	300
1,080	130.0	63.3	43.0	18.0	33.0	None...	8- 6	None...	None...	0° up 2° low	7,130	1,800	4,948	12,078	41.0	15.1	11.2	102.0	0	58.0	10	5,800	14,960	410
456	.....	.....	.....	.....	.....	None...	6- 2	5	4°	1½°	1,800	.....	1,350	3,150	42.8	14.9	7.11	95.0	0	47.0	10	5,500	18,000	350
350	36.0	.....	.....	.....	.....	None...	5- 9	5½	3°	1½°	1,430	.....	720	2,150	33.5	12.1	6.2	107.0	0	46.0	10	5,100	.....	.....
261	21.0	15.0	17.0	4.8	7.9	None...	4- 4	12	None...	None...	1,666	330	766	2,432	31.3	8.1	9.32	147.0	0	.....	8.9	10,000	23,500	275
355	41.3	26.7	21.6	4.3	9.6	None...	5- 0	12	.....	1½°	1,477	200	955	2,432	29.3	16.2	6.8	110.0	0	40.0	.....	.....	17,150	.....
656	84.0	55.0	41.0	10.5	26.0	None...	7- 2½	None...	None...	2½° low	2,630	.....	1,320	3,950	33.4	11.0	6.0	82.0	0	47.0	10	4,100	.....	492
678	78.0	36.4	42.0	15.8	21.8	None...	5- 0	12	None...	2° low	3,711	690	2,265	5,976	37.9	16.2	8.8	91.0	0	55.0	.....	.....	.....	.....
152	.....	12.3	4.7	1.8	5.3	None...	3- 9	18	None...	Some...	581	75	239	820	29.2	13.7	5.4	95.0	0	35.0	10	10,000	.....	.....
346	33.0	44.0	32.0	9.0	14.6	None...	None...	Taper	ed Wings	2°	1,870	550	1,150	3,020	38.0	15.1	8.7	115.0	1,000	45.0	.....	.....	.....	.....
320	.....	.....	.....	.....	.....	None...	5- 0	Some...	None...	.....	947	.....	545	1,492	36.5	16.6	4.66	96.0	0	35.0	1	1,150	.....	312
645	44.0	16.0	34.0	4.0	22.0	None...	6- 3	None...	None...	2°	2,864	840	2,700	5,564	48.5	9.3	8.63	135.0	0	.....	10	9,000	.....	.....
228	18.0	18.0	16.0	7.5	9.5	None...	4- 9	16⅝	/Tapered \Wings	None...	2,485	544	740	3,225	22.9	5.1	14.1	.....	.....	.....	.....	.....	.....	.....
475	60.0	18.0	25.0	5.0	13.0	None...	5- 1	26	None...	None...	2,800	900	1,400	4,200	33.4	10.5	8.85	126.0	0	45.0	8	10,000	22,000	500
435	35.0	28.1	22.0	4.0	12.0	None...	5- 1¼	12⅛	None...	1°	1,700	173	700	2,400	29.2	16.0	5.51	80.0	.....	40.0	10	4,000	7,000	.....

German Airplanes.

WING AND TAIL DATA—*Continued*											WEIGHT IN LBS.					PERFORMANCE								
Areas in Square Feet							Gap, Ft.-In.	Stagger, In.	Sweep-back	Dihedral	Empty	Gas and Oil	Useful Load	Total Gross	Useful per Cent Gross	Lb. H.P.	Lb. Sq. Ft.	High Speed		Low Speed, M.P.H.	Climb		Service Approx. Ceiling (Feet)	Range at High Speed (Miles
Wings Total	Ailerons	Stabilizer	Elevators	Vertical Fin	Rudder	Non-Skid Plane												M.P.H.	Altitude (Feet)		Minutes	Feet		
....	....	....	....	....	....	....	....	....	....	....	1,960	....	950	2,910	32.6	16.1	....	98.0	SL	....	31.0	16,400	....	300
....	....	....	....	....	....	....	....	....	....	....	6,600	....	2,000	8,600	23.2	16.5	....	110.0	SL	....	10.0	3,300	....	....
3,600	267.0	290.0	172.0	57.0	107.0	None	....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,760	205.0	202.0	87.0	78.5	46.3	None	....	....	None	....	14,200	....	4,000	18,200	22.0	19.0	6.6	90.0	SL	....	....	....	....	....
2,430	226.0	254.0	107.0	15.0	47.3	None	....	....	None	....	14,400	....	7,000	21,400	32.7	20.6	8.8	....	....	....	....	....	....	....
2,430	226.0	226.0	94.7	30.1	48.4	None	....	....	....	....	14,000	....	7,000	21,000	33.0	19.4	8.6	110.0	....	....	....	....	....	....
115	....	....	....	....	....	....	....	....	....	....	890	....	440	1,330	33.1	9.5	11.6	124.0	SL	....	19.5	19,800	....	200
452	....	....	....	....	....	....	....	....	....	....	2,645	....	1,480	4,125	35.9	22.3	9.1	115.0	SL	....	45.0	13,000	....	500
189	....	....	....	....	....	....	....	....	....	....	1,400	....	515	1,915	26.9	9.9	10.1	124.0	SL	....	18.2	19,800	....	200
451	....	....	....	....	....	....	....	....	....	....	2,640	....	1,540	4,180	36.9	22.6	9.3	93.0	SL	....	45.0	13,200	....	744
686	....	....	....	....	....	....	....	....	....	....	5,320	....	1,580	6,900	22.8	13.3	10.1	112.0	...	....	38.0	19,500	....	....
850	....	....	....	....	....	....	....	....	....	....	5,880	....	2,140	8,020	26.7	15.4	9.4	100.0	....	....	56.0	19,500	....	....
307	....	....	....	....	....	....	4-11	15.5	None	....	1,160	240	....	....	....	....	....	115.0	....	....	12.6	9,800	29,500	450
484	....	....	....	....	....	....	4- 3	12	....	....	2,380	420	....	....	....	....	....	109.0	....	....	16.0	9,800	21,300	440
159	20.5	12.2	18.2	None	8.2	None	....	....	None	3°	....	....	....	....	....	....	....	....	....	....	....	....	....	....
533	64.8	49.0	33.6	12.0	17.0	None	6- 8	....	5°	0° up 3° low	3,724	....	845	4,569	18.5	19.9	8.6	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	2,245	550	1,650	3,895	42.3	21.1	....	112.0	5,000	50	35.0	12,000	23,000	1200
185	6.5	13.7	....	....	....	....	2- 6	....	....	....	860	85	690	1,550	44.5	9.7	8.4	....	....	....	....	....	....	....
384	55.8	28.7	18.4	4.6	6.8	None	6- 1	....	2¾°	1¾°	1,760	....	1,210	2,970	40.7	18.5	7.7	100.0	SL	48	22.0	6,500	14,700	....
....	....	....	....	....	....	....	....	....	....	....	407	....	220	627	35.0	....	....	67.0	SL	....	....	....	....	150
278	20.8	(27.8	Tot.)	(10.3	Tot.)	None	....	....	None	....	1,560	240	790	2,350	33.6	14.7	8.5	103.0	....	....	10.0	6,500	....	310
1,900	....	....	....	....	....	None	....	....	....	....	12,000	....	6,700	18,700	35.8	18.0	9.8	118.0	SL	56	....	....	11,470	....

Specifications of For

(Compiled for Automotive Indu

Manufacturer and Model	Type	Use	GENERAL: Over-all Dimensions Length, Ft.-In.	Height, Ft.-In.	Width, Ft.-In.	Crew and Pass.	POWER PLANT: Engines No.	Make	Total H.P.	WING AND TAIL DATA: Angle of Incidence Upper	Lower	Chord Upper, Ft.-In.	Lower, Ft.-In.	Span Upper, Ft.-In.	Lower, Ft.-In.
BRITISH															
Airco—DH-11	TB Land	B	45- 0	13- 6	62- 0	4	2	A.B.C Dragonfly	640	....	....	....	....	62- 0	62-0
Airco—DH-14	TB Land	M	....	....	....	....	1	Rolls-Royce	600	....	....	....	....	....	....
Airco—DH-15	TB Land	B	....	....	....	....	1	B.H.P.-Atlantic	500	....	....	....	....	....	....
Airco—DH-16	TB Land	P	31- 9	11- 4	46- 6	5	1	Napier-Lion	450	....	....	5- 9	5- 9	46- 6	46- 6
Airco—DH-18	TB Land	P	39- 0	13- 6	50- 5	9	1	Napier-Lion	450	3°	3°	6- 6	6- 6	50- 5	50- 5
Austin—Kestrel	TB Land	SP	25- 6	10-2½	38- 6	2	1	Beardmore	200	....	....	6- 0	6- 0	38- 6	38- 6
Avro—Baby Sport	TB Land	SP	18- 6	7- 6	23- 0	1	1	Green	40	4½°	4½°	4- 0	4- 0	23- 0	23- 0
Avro—547 Triplane	TT Land	P	29-10	14- 5	37- 3	5	1	Beardmore	160	4°	4°	All- 4-9¾		All- 37-3	
Avro—547A Triplane	TT Land	P	29-10	14- 6	37- 0	5	1	Siddeley-Puma	240	....	....	....	....	All- 37-0	
Avro—548	TT Land	SP	29- 5	10- 5	36- 0	3	1	Renault	80	....	....	....	....	All- 36-0	
B. A. T.—Com'm'l. MK. I	TB Land	C	34- 8	11- 3	46- 0	5	1	Rolls-Royce Eagle	360	....	....	....	....	46- 0	46- 0
B. A. T.—Crow	TM Land	SP	14- 0	5- 0	19- 0	1	1	A. B. C. Gnat	40	....	....	....	....	19- 0	....
Beardmore—W. B. IX	TB Amph	P	61- 0	20- 6	107- 0	12	4	Beardmore	800	....	....	....	....	107- 0	107- 0
Beardmore—W. B. X	TB Land	SP	26- 0	11- 0	46- 0	2	1	Beardmore	200	....	....	....	....	46- 0	46- 0
Bristol—Tourer	TB Seaplane	P	25- 9	10- 1	39- 3	3	1	Rolls-Royce	275	....	....	5- 6	5- 6	39- 3	39- 3
Central—Centaur 2A	TB Land	P	39- 3	12- 6	63- 6	9	2	Beardmore	320	....	....	7- 6	7- 6	63- 6	63- 6
Central—Centaur 4B	TB Seaplane	P	27- 1	11- 4	39- 0	3	1	Anzani	100	....	....	....	....	39- 0	39- 0
Fairey—Amphibian	TB Amph	P	34- 4	12- 0	46-1½	3	1	Napier Lion	450	4½°	4½°	5- 6	5- 6	46-1½	46-1½
Graham-White—AeroLimousine	TB Land	P	40- 6	11- 0	60- 0	9	2	Rolls-Royce Eagle	640	....	....	6- 7	6- 7	60- 0	60- 0
Handley-Page—W-8	TB Land	P	60- 0	17- 0	75- 0	..	2	Cosmos-Jupiter	900	....	....	....	....	75- 0	75- 0
Handley-Page—W-8A	TB Land	P	60- 0	17- 0	75- 0	17	2	Napier Lion	900	....	....	....	....	75- 0	75- 0
Martinsyde—Semi-Quaver	TB Land	S	19- 3	7- 3	20- 2	1	1	Hispano-Suiza	300	....	....	....	....	20- 2	20- 2
Martinsyde—A-Mark II	TB Land	P	29-1½	10- 6	43- 4	5	1	Hispano-Suiza	300	....	....	....	....	43- 4	43- 4
Nieuport—Goshawk	TB Land	SP	....	....	20- 6	..	1	A. B. C. Dragonfly	320	....	....	3-10	3-10	....	....
Short—Shrimp	TB Seaplane	C	33- 0	12- 6	44- 0	4	1	Beardmore	160	....	....	....	....	44- 0	44- 0
Short—Silver Streak	TB Land	SP	26- 5	10- 6	37- 6	1	1	Siddeley-Puma	260	....	....	5- 3	5- 3	37- 6	37- 6
Sopwith—Gnu (Le Rhone)	TB Land	SP	25- 6	10- 0	38- 0	3	1	Le Rhone	110	....	....	5- 6	5- 6	38- 0	38- 0
Sopwith—Gnu (Bentley)	TB Land	SP	25- 6	10- 0	38- 0	3	1	Bentley	200	....	....	5- 6	5- 6	38- 0	38- 0
Sopwith—Grasshopper	TB Land	T	23- 1	8- 9	33- 1	2	1	Anzani	100	....	....	5-1½	5-1½	33- 1	33- 1
Sopwith—Antelope	TB Land	P	30- 6	11- 0	46- 6	3	1	Hispano-Suiza	180	....	....	....	....	46- 6	46- 6
Sopwith—Dove	TB Land	SP	19- 6	9- 6	25- 0	2	1	Le Rhone	80	....	....	....	....	25- 0	25- 0
Saunders—Kittiwaki	TB Amph	P	43- 8	14- 9	68- 3	9	2	A. B. C. Wasp II	400	....	....	7- 0	7- 0	68- 3	68- 3
Supermarine—Amphibian	PB Amph	C	33- 0	14- 0	50- 0	..	1	Rolls-Royce Eagle	360	4°	4°	6- 6	6- 6	50- 0	47- 0
Supermarine—Channel	PB Boat	C	30- 0	13- 0	50- 3	4	1	Beardmore	160	....	....	....	....	50- 3	50- 3
Supermarine—Sea King	PB Boat	SP	24- 0	10- 3	30- 5	2	1	Beardmore	160	....	....	....	....	30- 5	30- 5
Vickers—Viking III	PB Amph	SP	32- 0	13- 0	46- 0	6	1	Napier Lion	450	....	....	6- 0	6- 0	46- 0	46- 0
Westland—6 Seater Limousine	TB Land	P	33- 6	12- 6	54- 0	6	1	Napier Lion	450	2¼°	2¼°	7- 3	7- 3	54- 0	54- 0
Blackburn—Swift	TB Land	STP	35- 6	12- 0	48- 6	1	1	Napier Lion	450	....	....	....	....	....	....
Martinsyde—F-4A	TB Land	....	25- 6	8-10	32- 9	2	1	Hispano-Suiza	300	....	....	....	....	....	....
FRENCH															
A. Bernard—A-B3	TB Land	B	37- 1	12- 0	62- 6	2	2	Hispano-Suiza	400	....	....	....	62- 6	62- 6	....
Bleriot—Mammouth	TB Land	P	50- 6	21- 0	88- 6	28	4	Hispano-Suiza	1200	....	....	....	....	88- 6	....
Borel—1920	TB Land	SP	23- 6	8- 7	37- 5	1 or 2	1	Hispano-Suiza	300	1½°	1½°	5- 3	5- 3	37- 5	....
Borel—Gordon-Bennett	TB Land	SP	23- 3	....	23- 4	1	1	Hispano-Suiza	300	....	....	2-11	2-11	23- 4	....
Breguet—14T	TB Seaplane	P	32- 9	....	47- 1	4	1	Renault	300	....	....	....	....	47- 1	40- 7
Breguet—17C-2	TB Land	F	26- 6	....	46-10	2	1	Renault	300	....	....	....	....	46-10	41- 2
Breguet—18T Berline	TB Land	C	36- 0	11- 7	57- 0	8	1	Renault	450	....	....	....	....	57- 0	57—0
Caudron—C-25	TB Land	C	62- 4	18- 0	82- 0	18	3	Salmson	750	....	....	....	....	82- 0	82- 0
Caudron—C-33	TB Land	C	31- 7	9-10	50-10	4	2	Le Rhone	160	....	....	....	....	50-10	46- 7
De Marcay—Passe-Partout	TB Land	SP	10-5½	....	18-1½	1	1	A. B. C.	10	....	....	....	....	18-1½	18-1½
De Marcay	TB Land	SP	13- 9	....	16- 5	1	1	Le Rhone	60	....	....	....	....	16- 5	16- 5
De Marcay—Tourer	TB Land	P	16- 9	....	19- 6	2	1	Le Rhone	60	....	....	....	....	19- 6	19- 6
De Marcay—Pursuit	TB Land	S	....	....	30- 4	1	1	Hispano-Suiza	300	....	....	....	....	30- 4	18- 9
Farman—David	TB Land	SP	19-11	....	23- 3	2	1	Gnome-Rhone	60	....	....	4-11	4-11	23- 3	19- 4
Farman—Goliath	TB Land	P	42- 8	16- 1	82- 0	14	3	Salmson	780	....	....	10- 1	10- 1	82- 0	82- 0
Gordou-Lesseure	TM Land	S	21- 1	7-10	30-10	1	1	Hispano-Suiza	180	....	....	6- 7	....	30-10	....
Latham—Flying Boat	1P 2TB Boat		60- 0	19- 7	104- 0	..	3	Panhard-Levassor	1020	....	....	....	....	104- 0	78- 9
Levavasseur—Variable Wing	TB Land	EX	36- 0	9- 6	44- 9	1	1	Salmson	250	3° to 5.5°	3°	5-3 to 10-9	3- 7	44- 9	42- 9
Liore—Et Olivier	TB Boat	C	44- 4	13- 4	75-10	5	3	1-Salmson-250 2-Hispano-Suiza-150	550	....	....	9- 3	7-10	70- 1	75-10
Liore—Et Olivier	TB Land	TF	27- 3	11- 0	47- 1	2	2	Le Rhone	350	....	....	....	....	47- 1	42- 2
Morane-Saulnier—AS	TM Land	SP	18- 4	10- 4	28- 8	1	1	Le Rhone	80	....	....	....	....	28- 8	....
Morane-Saulnier—AR	TM Land	SP	22- 2	11- 2	34- 6	2	1	Le Rhone	80	....	....	....	....	34- 6	....
Morane-Saulnier—AN	TB Land	S	17- 5	9- 0	38- 6	2	1	Liberty	400	....	....	....	....	38- 6	38- 6
Morane-Saulnier—AI	TM Land	S	19- 0	8- 1	29- 1	1	1	Le Rhone	1?0	....	....	....	....	29- 1	....
Nieuport—28	TB Land	SP	20- 5	....	26- 3	1	1	Le Rhone	180	....	....	....	....	26- 3	26- 3
Nieuport—29C-1	TB Land	S	21-10	8- 5	32- 2	1	1	Hispano-Suiza	300	....	....	4-11	4-11	32- 2	....
Nieuport—29 Vitesse	TB Land	SP	20- 4	8- 3	19- 7	1	1	Hispano-Suiza	300	....	....	3-11	3-11	17-11	19- 7
Nieuport—30T	TB Land	C	35- 1	....	47- 1	...	1	Renault	450	....	....	8- 6	8- 6	44- 3	47- 7
Pischoff—Avionette	TB Land	SP	11- 7	4- 7	17- 0	1	1	Clerget	16	....	....	....	....	17- 0	....
Potez—IV C2	TB Land	F	27- 6	....	39- 4	2	1	Lorraine-Dietrich	400	....	....	....	....	39- 4	39- 4
Potez—VII	TB Land	C	30- 0	....	46- 0	2	1	Lorraine-Dietrich	400	....	....	....	....	46- 0	46- 0
Potez—VIII	TB Land	SP	15- 5	6- 7	26- 3	2	1	Potez A-4	50	....	....	4- 7	4- 7	36- 3	22- 4
S. P. A. D.—Herbemont	TB Land	SP	24- 0	....	21- 0	1	1	Hispano-Suiza	300	....	....	....	....	21- 0	....
S. P. A. D.—S-27	TB Land	SP	24- 0	9- 3	31-10	3	1	Hispano-Suiza	300	....	....	....	....	31-10	31-10
Wibault	TB Land	F	20- 8	7- 7	25- 7	1	1	Hispano-Suiza	220	....	....	....	....	25- 7	25- 7
ITALIAN															
Ansaldo—A-300C	TB Land	C	32- 3	10- 8	43-10	6	1	F. I. A. T.	300	....	....	....	....	43-10	43-10
P. R. B.—1	3P 2TB Boat	C	54- 2	21- 8	102- 8	..	4	Isotta-Frachini	1000	....	....	13-10	13-10	102- 8	98- 6
F. I. A. T.—12 Passenger	TB Land	P	43-10	14- 9	68-10	12	3	F. I. A. T.	700	....	....	10- 6	10- 6	68-10	59- 9
F. I. A. T—ARF	TB Land	SP	33- 3	12- 2	53- 2	2	1	F. I. A. T.	700	....	....	....	....	53- 2	53- 2
Ricci—RI	1P 2T Seaplane	C	42-10	13-10	85- 9	13	3	Isotta-Frachini	660	....	....	....	....	85- 9	85- 9
Ricci—Triplane	TT Land	SP	11- 0	6- 7	10- 4	1	1	Anzani	40	....	....	....	....	All	10-4
Savoia—S-16	PB Boat	C	32-10	11-10	48-11	5	1	F. I. A. T.	300	....	....	6- 7	5-11	48-11	48-11

NOTE: Airplanes announced and never built omitted as far as possible. Airplanes for which complete data was not available omitted. **ABBREVIATIONS: B**—Bombing; **C**—Commercial (passenger and freight); **DB**—Day bombing; **Ex**—Experimental; **F**—Fighting; **M**—Mail carrier; **MS**—Messenger; **P**—Passenger; **PB**—Pusher biplane; **PM**—Pusher monoplane; **PT**—Pusher triplane; **S**—Scout or pursuit; **SP**—Sport including racing;

eign Airplanes 1920-1921

stries by Arch. & Don R. Black)

WING AND TAIL DATA—*Continued*										WEIGHT IN LBS.					PERFORMANCE							
AREAS IN SQUARE FEET							Gap, Ft.-In.	Stagger, In.	Sweep-back	Dihe-dral	Empty	Gas and Oil	Useful Load	Total Gross	Useful per Cent Gross	Lb. H.P.	Lb. Sq. Ft.	HIGH SPEED M.P.H.	HIGH SPEED Altitude (Feet)	Low Speed, M.P.H.	CLIMB Minutes	CLIMB Feet	Service Approx. Ceiling (Feet)	Range at High Speed (Miles)
Wings Total	Ailer-ons	Stab-lizer	Eleva-tors	Verti-cal Fin	Rud-der	Non-Skid Plane																		
719	102.0	55.0	30.5	7.4	20.0	....	5-10 to 7-2	None	None	4° up 2° low	3,795	1,300	3,205	7,000	45.8	10.3	9.7	117.0	....	....	13.5	10,000	.....	350
....	....	....	....	....	....	....	....	....	None	....	4,000	1,400	3,000	7,000	42.9	11.6	....	129.0	6,500	....	....	....	19,000	....
....	....	....	....	....	....	....	....	....	....	....	3,312	950	1,461	4,773	31.6	9.5	....	136.0	6,500	....	82.0	10,000	20,000	....
490	74.4	38.0	24.0	5.4	13.7	None	5- 6	16	None	3°	3,155	....	1,595	4,750	33.6	9.5	9.7	136.0	SL	....	10.0	10,000	....	350
618	23.0	56.0	24.2	6.4	18.0	None	6-10	None	None	3°	4,180	800	2,550	6,730	37.9	13.5	10.9	121.0	SL	....	20.5	10,000	16,000	395
417	....	....	....	....	....	None	....	None	None	....	1,606	....	774	2,740	28.3	15.7	6.6	110.0	SL	45	12.0	10,000	....	325
176	21.0	14.5	7.8	None	7.0	None	4-3	18	None	3°	630	75	310	940	33.0	24.4	5.5	82.0	SL	40	35.0	10,000	12,000	225
498	69.0	26.5	18.5	7.3	9.0	None	4-9	None	None	2¼°	2,077	320	923	3,000	30.7	18.8	6.0	94.0	SL	45	38.0	10,000	....	444
498	....	....	....	....	....	None	....	None	None	....	2,080	....	1,206	3,286	36.5	13.7	6.6	98.0	SL	52	28.0	10,000	....	375
330	....	....	....	....	....	None	....	....	None	....	1,338	....	605	1,943	31.1	24.3	5.8	80.0	....	....	15.5	5,000	....	180
580	....	....	....	....	....	None	....	None	None	....	2,700	....	1,800	4,500	40.0	13.0	7.7	128.0	....	....	4.0	5,000	....	670
76	....	....	....	....	....	None	....	....	None	....	225	....	225	450	50.0	11.2	6.0	65.0	SL	....	....	....	....	130
2,202	....	....	....	....	....	None	....	None	None	....	9,720	2,120	4,280	14,000	30.5	19.4	6.4	93.0	SL	46	14	5,000	....	403
																					38.0	10,000		
540	....	....	....	....	....	None	....	....	None	....	1,852	....	997	2,849	35.0	....	....	91.0	SL	50	27.0	10,000	....	....
405	....	....	....	....	....	None	....	....	....	....	1,750	515	1,050	2,080	37.5	10.2	6.9	125.0	....	....	12.0	10,000	....	....
895	140.0	65.0	32.0	15.0	20.0	None	7-6	None	None	....	3,840	400	2,000	5,840	34.2	16.7	6.6	89.0	SL	38	....	....	....	350
380	....	....	....	....	....	None	....	None	None	....	1,230	....	670	1,900	35.2	19.0	4.9	75.0	SL	....	2.6	1,000	....	225
544	....	....	....	....	....	....	5-7	None	None	1°40′	3,771	....	....	....	....	10.4	9.6	118.5	SL	54	....	....	....	....
765	106.0	52.0	32.0	11.3	25.0	None	6- 6	....	....	4°	5,800	1,160	2,170	7,970	27.2	24.5	10.4	116.0	SL	50	9.9	10,000	17,000	....
1,500	....	....	....	....	....	None	....	None	None	....	....	....	....	12,000	....	....	....	112.0	SL	45	14.0	9,000	18,000	600
1,500	....	....	....	....	....	None	....	None	None	....	....	....	....	12,000	....	13.3	8.0	119.0	SL	55	....	....	....	750
302	....	....	....	....	....	....	....	....	....	....	2,025	....	....	....	....	13.8	6.7	160.0	SL	....	....	....	....	....
519	....	....	....	....	....	None	....	....	None	....	2,700	800	1,300	4,000	32.5	13.3	7.7	115.0	SL	....	....	....	....	550
....	....	....	....	....	....	....	....	None	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
500	....	....	....	....	....	None	....	None	None	....	2,095	285	1,005	3,100	33.9	15.5	6.2	83.0	SL	....	35.0	10,000	....	250
370	....	....	....	....	....	None	5- 0	None	None	....	1,865	425	1,005	2,870	36.6	11.0	7.9	120.0	SL	50	11.0	10,000	....	360
354	....	....	....	....	....	None	5- 0	11	None	2½°	1,350	....	810	2,160	37.5	19.6	6.1	93.0	SL	....	7.8	5,000	....	230
354	....	....	....	....	....	None	5- 0	11	None	2½°	1,580	....	820	2,400	34.1	12.0	6.8	110.0	SL	50	5.5	5,000	....	200
301	....	....	....	....	....	None	....	....	None	4°	1,020	....	650	1,670	38.9	16.7	5.5	90.0	....	....	....	....	....	180
550	....	....	....	....	....	None	....	None	None	....	2,100	....	900	3,000	30.0	16.6	5.4	110.0	SL	43	7.5	5,000	....	400
213	....	....	....	....	....	None	....	....	....	....	850	....	580	1,430	40.5	17.8	6.7	100.0	SL	....	7.5	5,000	....	200
864	60.0	67.0	45.0	40.5	28.0	None	7- 0	None	None	....	3,840	800	2,360	6,200	38.1	15.5	7.2	....	....	....	....	....	....	....
600	....	....	....	....	....	None	....	None	None	2° up 4° low	3,996	....	1,364	5,360	25.5	15.4	9.0	94.0	SL	55	....	....	....	....
453	....	....	....	....	....	....	....	None	None	....	....	....	....	3,400	....	21.2	7.5	85.0	SL	....	....	....	....	340
284	....	....	....	....	....	None	....	None	None	....	....	....	....	2,500	....	15.6	8.9	103.0	SL	....	20.0	10,000	....	....
520	....	....	....	....	....	None	7- 0	None	None	....	2,740	....	1,805	4,545	39.7	13.0	9.0	121.0	SL	52	11.0	6,000	....	440
726	108.0	40.0	30.0	9.8	15.9	None	7- 0	9	None	2½°	....	730	....	5,550	....	12.3	7.6	120.0	SL	46	....	....	....	450
720	....	....	....	....	....	....	....	....	....	....	3,100	....	....	6,000	....	13.3	8.3	112.0	....	....	....	850	....	448
328	....	....	....	....	....	....	....	....	....	....	....	....	....	2,300	....	7.5	7.0	142.0	....	....	....	....	....	287
860	....	....	....	....	....	....	....	None	None	....	3,610	1,200	3,190	6,800	46.9	17.0	7.9	101.0	SL	....	49.2	13,000	16,000	500
1,600	....	....	....	....	....	....	....	None	None	....	8,360	3,300	4,950	13,310	....	....	....	94.0	SL	....	....	....	....	540
364	....	18.8	16.6	5.4	9.7	None	....	14½	None	2° up 0° low 2°	1,800	....	1,100	2,900	37.9	9.7	8.0	151.0	SL	....	15.0	13,000	20,000	....
140	....	....	....	....	....	....	....	....	....	....	....	....	....	1,870	....	6.2	13.4	....	....	....	....	....	....	....
534	....	....	....	....	....	None	....	....	None	....	2,820	550	1,360	4,180	32.5	13.9	7.8	103.0	SL	....	18.0	6,500	....	....
490	....	....	....	....	....	None	....	....	None	....	2,640	715	1,460	4,100	35.6	13.7	8.4	136.0	SL	....	5.5	6,500	....	....
791	....	....	....	....	....	None	....	....	None	....	3,540	970	2,400	5,940	40.4	13.2	7.5	106.0	SL	....	17.0	8,500	17,000	....
1,670	....	....	....	....	....	None	....	....	None	....	7,500	1,980	4,600	12,100	38.0	16.1	7.3	103.0	....	....	....	....	....	620
503	....	....	....	....	....	None	....	....	None	....	1,950	405	1,080	3,030	35.6	19.6	6.0	80.0	SL	....	....	....	....	480
....	None	....	....	....	....	None	....	....	None	None	....	....	....	385	....	38.5	....	68½	....	....	....	....	....	137
....	....	....	....	....	....	None	....	....	None	None	....	....	....	573	....	....	....	118.0	....	28	....	....	....	....
....	....	....	....	....	....	None	....	....	None	None	....	....	....	650	....	....	....	93.0	....	35	....	....	....	186
....	....	....	....	....	....	....	....	None	None	None	....	....	....	2,368	....	7.9	....	156.0	SL	....	16.25	16,400	....	....
210	18.8	10.7	9.4	None	4.2	None	....	21½	None	None	460	....	440	900	49.0	15.0	4.3	80.0	SL	30	13.4	6,500	....	240
1,505	....	48.4	....	....	24.0	....	....	None	None	....	6,560	2,200	4,740	11,300	42.0	14.5	7.5	100.0	SL	....	8.0	6,500	....	....
202	23.7	13.8	14.0	3.4	6.7	None	....	....	....	....	1,254	220	594	1,848	32.3	10.3	9.2	155.0	SL	....	17.5	16,400	24,600	....
1,925	....	....	....	....	....	None	....	....	None	....	....	....	6,600	....	....	....	....	....	....	....	34.0	10,000	....	....
345 to 560	47.0	95.0	35.0	25.0	16.0	None	4- 7	12 to 36	None	3°	2,750	220	350	3,100	11.3	12.4	5.5 to 9.0	125.0	SL	35	....	....	25,000	....
1,150	....	....	....	....	....	....	8- 5	None	6°	None	6,250	1,010	3.210	9,460	34.0	17.2	8.2	87.0	SL	....	....	....	10,000	350
508	38.7	....	19.4	....	30.0	None	....	25	None	....	2,690	....	1,490	4,180	36.5	11.6	8.0	115.0	SL	....	39.0	16,400	18,000	460
140	....	....	....	....	....	None	....	....	....	....	840	....	330	1,170	28.2	14.6	8.4	103.0	SL	45	18.5	10,000	20,000	300
194	....	....	....	....	....	None	....	....	None	....	880	....	500	1,380	36.2	17.2	7.1	94.0	SL	35	19.2	10,000	20,000	300
447	....	....	....	....	....	....	....	....	....	....	2,640	....	1,245	3,885	32.0	9.7	8.7	125.0	SL	81	25.0	9,800	20,000	375
140	....	....	....	....	....	....	....	....	....	....	980	....	560	1,540	36.4	8.6	10.9	139.0	SL	75	7.5	9,800	23,000	417
172	....	....	....	....	....	....	....	....	....	....	880	240	660	1,540	42.8	8.6	8.9	129.0	SL	....	19.8	16,000	22,000	258
288	25.8	22.0	18.2	3.8	8.6	None	....	....	None	....	1,670	370	760	2,430	31.3	8.1	8.4	141.0	SL	....	6.8	9,800	25,000	350
132	13.2	13.0	8.1	4.7	4.8	None	4- 5	7.4	None	2° up 0° low	1,520	320	600	2,120	28.3	7.1	16.0	168.0	SL	....	....	....	....	....
700	56.6	64.6	36.6	....	15.0	None	....	....	....	....	3,300	550	1,980	5,280	37.5	11.7	7.5	....	....	....	....	....	....	....
81	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60.0	....	....	52.0	3,600	....	120
409	....	....	....	....	....	None	....	None	None	....	2,240	....	1,290	3,530	36.5	8.8	8.6	135.0	SL	....	21.8	16,400	24,600	435
474	....	....	....	....	....	None	....	None	None	....	2,425	....	1,212	3,637	33.3	9.1	7.7	124.0	SL	....	....	....	....	320
205	....	15.6	10.2	7.0	4.8	None	4-10	....	....	....	484	88	440	924	47.6	18.5	4.5	....	....	25	....	....	....	....
161	....	....	....	....	....	....	....	....	....	....	....	....	....	2,310	....	7.7	15.0	....	....	....	....	....	....	....
....	....	....	....	....	....	None	....	....	....	....	1,870	....	900	2,770	32.5	9.2	....	144.0	SL	65	....	....	....	432
235	....	....	....	....	....	....	....	....	....	....	1,410	242	450	1,860	24.2	8.5	7.9	148.0	....	....	....	....	21,000	370
473	....	....	....	....	....	None	....	None	None	....	2,535	....	1,653	4,188	39.5	13.8	8.8	112.0	....	....	....	....	....	500
2,215	....	172.0	....	....	48.4	....	13- 2	....	....	....	8,800	....	7,260	16,060	45.2	16.1	7.3	100.0	SL	....	30.6	13,200	....	1000
1,289	56.5	35.0	50.0	8.0	22.0	None	8- 6	None	None	....	7,040	1,650	3,960	11,000	36.0	15.6	8.6	125.0	SL	50	....	....	15,000	700
....	....	....	....	....	....	None	....	None	None	....	5,070	4,660	5,130	10,200	50.3	....	....	160.0	....	....	....	....	....	2730
1,300	....	....	....	....	....	None	....	None	None	....	6,160	....	4,760	10,920	43.6	16.5	8.4	105.0	SL	....	....	....	....	420
118	....	....	....	....	....	....	....	....	....	....	330	....	242	572	42.3	14.3	4.8	78.0	SL	24	....	....	....	150
570	....	....	....	....	....	None	....	None	None	....	2,860	....	1,760	4,620	38.1	15.4	8.1	105.0	....	....	....	....	....	420

STP—Scout torpedo plane; **T**—Training; **TB**—Tractor biplane; **TPB**—Tractor pusher biplane; **TPM**—Tractor pusher monoplane; **TP**—Tractor pusher; **TF**—Trench fighter; **TM**—Tractor monoplane; **TP**—Torpedo plane; **TT**—Tractor triplane.

British Motorcycle Practice

Lightweight 2½ horsepower machine gaining in popularity, because of economy and the higher tax on heavy machines. Many machines have stock engine and gearset. Single-cylinder engine predominates. Two-cylinder opposed also popular. 52 per cent of gearsets are three speed.

By M. W. Bourdon

THE outstanding feature of the British motorcycle industry at the moment is the large and increasing number of makers turning out lightweight machines with single-cylinder two-stroke engines of approximately 2½ hp. with belt, or chain and belt transmission. This feature is accounted for by two facts, (1) the demand for a machine economical in upkeep and fuel and (2) the new scale of taxation which came into force on Jan. 1. The latter imposes an annual tax of $7.50 on machines weighing not more than 200 lb. and double that amount on those over that weight, sidecars for either class being taxed $5 extra.

The two-stroke engine for these light machines is favored on account of its simplicity and low cost of production, though the four-stroke type is also widely used for low-powered mounts; in fact, if the class be extended to include as a maximum the 2¾ hp. machine, it will be found that 55 per cent have four-stroke engines. But that extra ¼ hp. usually means that the machine is carried into another class in performance, price and taxation rating.

Only 38 per cent of makers used stock engines, and of these J. A. Prestwich (J.A.P. engines) supplies 60 per cent; a similar percentage of the small two-stroke stock motors are of Villiers make and have a flywheel magneto for ignition.

The single-cylinder engine still predominates in point of numbers on British motorcycles generally; taking all sizes, it appears on 57 per cent, the 43 per cent of twins being made up of 25 per cent with horizontally opposed cylinders and 75 per cent Vee. The latter are almost completely out of favor in sizes under 5-6 hp., the at one time popular 3½-4½ hp. Vee twin having been superseded by the horizontally opposed type, which is constantly finding new adherents. Non-detachable cylinder heads are the rule, only 24 per cent being detachable, and most of these of the horizontal twin type.

The majority of crankshaft bearings are plain bushes, but ball and roller types are both increasing in favor, though not infrequently only one of the latter is used and that on the belt pulley or chain sprocket end of the shaft with a plain bearing at the other end. Roller or ball bearings are also being more widely used for the connecting rod big end. The table shows that some 36 per cent of engines have roller bearings at this point.

The difficulty of keeping the overall height of vertical and Vee engines within reasonable bounds doubtless accounts very largely for the paucity of overhead valve gear. Only 6 per cent of engines have both valves in the head, and these are mostly horizontal twins. Superimposed valves also account for 6 per cent. Thus the majority (68 per cent) have side valves, though among these are some engines with the exhaust and inlet valves arranged around the cylinder at 90 deg. from one another, the exhaust being arranged in front of the cylinder to submit it to the best cooling effect from air draught. With only one or two notable exceptions (for example, the two-cylinder water-cooled Scott and the 4½ hp. Dunelt) the valveless engines are the small two-stroke motors already referred to. But both the Scott and the Dunelt have earned excellent reputations despite (or possibly on account of) their two-stroke engines, and have shown that there is no good reason why the two-stroke type should be confined to the lightweights.

Almost all engines have cast iron pistons, only 2 per cent being provided with aluminum. But this uniformity does not extend to lubrication systems, where there is quite a remarkable diversity of practice. Splash lubrication pure and simple is held sufficiently effective in 73 per cent of engines, the feed from the oil compartment of the frame tank being usually maintained by a pump, the plunger of which is lifted by hand against a spring which returns it gradually to its normal position, driving out the oil through a sight drip feed. Some splash systems embody a modification consisting of a mechanically operated pump in the crankcase which has a big ratio of reduction in speed (30-40 to 1) in its drive from the crankshaft. This pump draws oil from the tank and discharges it in small quantities into the crank chamber, where splash is depended upon.

The "petroil" lubricating system (oil mixed with fuel) for two-stroke motors is disappearing. Triumph (one of the largest firms) retains it for the present, but in most other engines of this type a drip feed and splash or drips led to a hollow crankshaft are displacing it.

Ninety-five per cent of the clutches used are of the plate or disk type. Two-speed gearsets for machines up to 2½ hp. almost invariably have only a single driven plate, but the larger machines have the multi-plate type, generally with 3 or 4 driven units. Fabric facings running dry are found in 90 per cent single and multi-plate, only 10 per cent being metal to metal in an oil bath. Clutch control is by hand on 86 per cent of machines, and this is accounted for by the fact that even the largest and most highly powered are double-purpose machines; when used in solo form the pedal controlled clutch is disliked, owing to the impossibility of straddling with both feet on the ground until the machine moves off with the full engagement of the clutch.

The majority (55 per cent) of gearsets are stock jobs and 80 per cent of these are Sturmey-Archer, either two or three-speed with the clutch integral. Three-speeds form 54 per cent of the total, two-speeds 32 per cent, 7 per cent have a single ratio with belt drive and 7 per cent belt drive with variable pulley; two of the best known makes—Rudge-Whitworth and Zenith—have the latter system, even on 6-8 hp. models. Only 9 per cent of gearsets are arranged as a unit with the engine, this being partly due to the popularity of J.A.P. engines and Sturmey-Archer gearsets, neither of which is designed for or adaptable to unit construction.

The fact that, with few exceptions, the large number of

two-stroke lightweights have chain and belt drive accounts for the latter system being the most widely used (48 per cent). This system, consisting of a primary chain from crankshaft to gearset and a Vee belt from the latter to the rear wheel, is also used on all powers of machines up to the largest, but nevertheless the all-chain transmission is increasing in popularity through the range above 2½ hp. Rarely is the final chain protected by more than a top mud shield, but the primary chain is usually enclosed and not infrequently lubricated by only vapor discharged from an extension of the crankcase breather pipe.

Rear sprung frames are showing no rapid increase, not because there is any falling off in the demand for better protection against road shock, but on account of the additional cost and weight. As regards the first, crudity in design is largely the cause, for some of the arrangements are involved beyond measure. That a simple but effective rear spring can be provided without lack of lateral stability (the bugbear of designers) is evident from one or two exceptions to the general rule—the Beardmore-Precision, for example, wherein a cantilever spring located behind and loosely speaking, parallel with the saddle tube, is used. The drawback of undue additional weight has not, however, been overcome even in these exceptional cases, and in view of the inherent stability and low weight of the rigid tubular construction, it is not difficult to realize why the extra weight of a sprung frame is far more than that represented by the actual spring or springs; the lateral flexibility of the springs must be counteracted by means which considerably increase the weight of the tubular portions.

Much the same difficulty has been experienced by those designers who have attempted to employ pressed steel frames; they have found that to retain the lateral rigidity and torsional strength of the tubular construction has necessitated an increase of frame weight up to 80 per cent. While the pressed steel form is obviously desirable from several standpoints, the tubular frame unquestionably has the advantage in low weight combined with stability.

Readily detachable and interchangeable wheels have not increased to any marked extent during the past twelve months, and they appear almost entirely in large sidecar machines, and by no means invariably in these. Of the non-interchangeable wheels 15 per cent have knock-out rear spindles, enabling the back wheel to be quickly detached for tire removal, without disturbing the transmission details or brake gear.

In regard to brakes, the horseshoe tire rim type still predominates (76 per cent) on front wheels, and the V block applying to the belt rim on a brake rim on the rear wheels. But for both back and front the expanding shoe or contracting band applying to a 10 to 12 in. drum is gradually gaining ground; the former, for example, is now used on 25 per cent of machines.

British motorcycle design has not shown any pronounced improvement, except in detail and equipment, since the war. Makers during the past two years have devoted all their energies to securing output and have meanwhile, in the majority of cases, neglected to evolve new designs differing to any marked extent from pre-war standards. That they have thus restricted their market there can be no question, for they have as yet made little or no attempt to cater to the vast number of potential purchasers who desire a machine which they can use for business purposes without being compelled, for the sake of cleanliness and warmth, to wear special clothing. It has been computed that this market is as large as that which calls for the present type of machine, and yet, with the exception of scooters, nothing has been offered to the men who desire a means of getting to and from their home and city office or from one business house to another in normal attire. But there are indications suggesting that a few firms have realized possibilities in this direction, and it will be surprising if during the next twelve months there are not developments representing a new starting point for a section of the industry.

Tendencies in British Truck Design

(*Continued from page* 354)

although the chassis of the larger capacity trucks is stiffer and the gear ratios are varied. The 3 tonner (6700 lb.), for instance, has a back axle gear ratio of 7.25 to 1, while the 5 to 6 tonner has a ratio of 10.3 to 1.

The wheel tracks of these heavier types vary considerably, running from 65 in. in the case of Leyland to 72 in.

Worm final drive has increased in popularity very considerably of late, and 52 per cent of chassis now have this form of transmission as compared with 23 per cent chains and 20 per cent double reduction. Only 5 per cent have straight bevel gearing and no British trucks use an internal gear final drive. Open propeller shafts are favored in the proportion of 69 per cent as compared with 13 per cent enclosed and 18 per cent semi-enclosed. The fabric disk joint at both ends of an open shaft occurs in 32 per cent of trucks being equalled in popularity only by the arrangement having a star joint at one end and a sliding pot joint at the other, which occurs in 33 per cent. In star joints plain bushes are generally used, though 11 per cent of all universals have ball bearings. There are only 13 per cent of trucks with both brakes applying to the back wheels; none of these are external brakes, though among the 77 per cent of vehicles in which a transmission brake occurs the vast majority have external shoes.

In regard to engine lubrication, 43 per cent of engines listed have the trough system as compared with 57 per cent hollow shaft. The trough system usually includes direct leads to the main crankshaft bearings and sometimes to the camshaft as well. Magneto ignition is universal, with variable hand timing in 90 per cent. Impulse starters do not, however, show up prominently, only 6 chassis being equipped with them as standard. Pump water circulation occurs in 85 per cent of engines, thermo-syphon in 12 per cent and thermo-syphon assisted by a belt-driven water accelerator in 3 per cent. The thermo-syphon system is not, however, confined to the smaller trucks, for the whole range of Commer cars, including the largest type with a load capacity of 11,000 lb., has the water naturally circulated in an engine with a bore and stroke of 4½ x 5½ in. No cellular radiators are used except for the lightest delivery vans, 84 per cent of trucks proper having vertical tubes, the remainder having horizontal tubes. With one exception, the Guy with a 5500 to 6000 lb. load capacity, all have gilled tubes, the exception having a bank of ⅜ plain brass tubes vertically arranged. Fifty-seven per cent of British trucks have no governor as part of the standard equipment, while only 10 per cent have electric lighting included, though of the remainder, 50 per cent have provision for a lighting generator.

Cone clutches predominate (79 per cent as compared with 19 per cent disk and 2 per cent multiple-disk). All gearsets except the Austin are separately mounted. Ball bearings for gearsets are general, and in 90 per cent the gear shafts are side by side.

Detailed Technical Specifications

NAME OF MACHINE	Model	POWERPLANT												TRANSMISSION				
		Cylinders				Piston Displacement (Cu. In.)	Cycle Type	Cooling Type	Lubrication Type	Carbureter Make	Engine Make	Ignition Make and Type	Maximum H. P. Development	Number of Speeds	Gear Ratio to One	Change Speed Gear Type	Clutch Type	Final Drive Type
		Number	Arrangement	Bore (In.)	Stroke (In.)													
Cleveland	1921	1	Vert.	2¾	2¾	.....	2	Air	Mix oil with gas.	Schebler	Own.	Bosch or Berling Mag	3½	2	6.20 11.00	Spur Gear	O-Disk.	Chain
Excelsior	520	2	Vee.	3 11/16	3½	61.0	4	Air	Splash	Schebler	.....	Simms Mag.	15	3	9.92 6.76 4.13	Prog Slid.	D-Disk.	Chain
Harley-Davidson	21-F	2	Vee.	3 1/16	3½	6.03	4	Air	Splash	Schebler	Own.	Bosch Mag.	16	3	9.77 6.51 4.34	Prog. Slid.	D-Disk.	Chain
Harley-Davidson	21-J	2	Vee.	3 1/16	3½	60.3	4	Air	Splash	Schebler	Own.	Own Gen.	16	3	9.77 6.51 4.34	Prog. Slid.	D-Disk.	Chain
Harley-Davidson	21-W	2	Oppos.	2¾	3	35.6	4	Air	Splash	Schebler	Own.	Bosch Mag.	8	3	13.88 8.33 5.00	Prog. Slid.	O-Disk.	Chain
Harley-Davidson	21-WJ	2	Oppos.	2¾	3	35.6	4	Air	Splash	Schebler	Own.	Own Gen.	8	3	13.88 8.33 5.00	Prog. Slid.	O-Disk.	Chain
Harley-Davidson	21-FD	2	Vee.	3 7/16	4	74.2	4	Air	Splash	Schebler	Own.	Bosch Mag.	19	3	9.77 66.51 4.34	Prog. Slid.	D-Disk.	Chain
Harley-Davidson	21-JD	2	Vee.	3 7/16	4	74.2	4	Air	Splash	Schebler	Own.	Own Gen.	19	3	9.77 6.51 4.34	Prog. Slid.	D-Disk.	Chain
Indian "Scout"	G-21	2	Vee.	2¾	3 1/16	36.3	4	Air	Splash and Force	Schebler	Own.	Splitdorf Mag.	11	3	12.05 7.67 4.88	Prog. Slid.	O-Disk.	Chain
Indian "Power Plus"	N-21	2	Vee.	3 1/16	3 11/16	60.8	4	Air	Splash and Force	Schebler	Own.	Splitdorf Mag.	15	3	10.47 6.65 4.24	Prog. Slid.	D-Disk	Chain
Henderson	K	4	Vert.	2 11/16	3½	7.90	4	Air	Force	Zenith	.....	Simms	16	1 Rev. 3 Ford	7.56 Ford 5.67 Ford 3.49 Ford 5.87 Rev.	Prog. Slid	O-Disk.	Chain
Iver-Johnson	16-7 T.S.	2	Vee.	3¼	3¾	62.2	4	Air	Splash	Schebler	Own.	Bosch Mag.	8	2	6.50 3.75	2-Speed Hub	.....	Chain
Iver-Johnson	16-7	2	Vee.	3¼	3¾	62.2	4	Air	Splash	Schebler	Own.	Bosch.	8	1	4.25	2-Speed Hub	.....	Chain
Iver-Johnson	16-4 T.C.S.	1	Vert.	3¼	3¾	31.1	4	Air	Splash	Schebler	Own.	Bosch.	5	2	6.50 3.75	2-Speed Hub	.....	Chain
Iver-Johnson	16-4 C	1	Vert.	3¼	3¾	31.1	4	Air	Splash	Schebler	Own.	Bosch.	5	1	4.25	2-Speed Hub	.....	Chain
Iver-Johnson	16-4 B	1	Vert.	3¼	3¾	31.1	4	Air	Splash	Schebler	Own.	Bosch.	5	1	.....	.....	Cone.	Belt
Reading-Standard	21-T	2	Vee.	3⅜	4	71.5	4	Air	Splash	Schebler	Own.	Bosch & Opt	16	3	3.91 6.00 9.20	Prog. Slid	D-Disk.	Chain
Reading-Standard	21-TE	2	Vee.	3⅜	4	71.5	4	Air	Splash	Schebler	Own.	Bosch & Opt.	16	3	3.91 6.00 9.20	Prog.	D-Disk.	Chain

Motorcycle Records

The M. & A. T. A. (Motorcycle & Allied Trades Association) is the governing body for motorcycle competition in the United States. Its records on Jan. 1, 1921, are as follows:

COMPETITIVE RECORDS

These records are for the best time made in M. & A. T. A. competition for the distance, regardless of the nature of the course and whether or not a National Championship was involved:

SOLO, 61 CUBIC INCHES

One Mile—45 2-5 secs.—Made by Gene Walker, Indian, Cleveland, Ohio, Sept. 19, 1920. (Mile dirt track.)

Two Miles—1:14 3-5—Made by Otto Walker, Harley-Davidson, Sheepshead Bay, N. Y., Oct. 11, 1919. (Two-mile speedway.)

Five Miles—3:50 4-5—Made by Gene Walker, Indian, Readville, Mass., Oct. 23, 1920. (Mile dirt track.)

Ten Miles—6:19 2-5—Made by Gene Walker, Indian, Sheepshead Bay, N. Y., Oct. 11, 1919. (Two-mile board speedway.)

Twenty-five Miles—18:40 3-5—Made by Gene Walker, Indian, Grand Island, Nev., July 4, 1919. (One and four-fifths mile dirt track.)

Fifty Miles—32:57 2-5—Made by Ray Weishaar, Harley-Davidson, Sheepshead Bay, N. Y., Oct. 11, 1919. (Two-mile board speedway.)

One Hundred Miles—1:07:57—Made by Albert Burns, Harley-Davidson, Sheepshead Bay, N. Y., Oct. 11, 1919. (Two-mile board speedway.)

Two Hundred Miles—2:26:46—Made by Maldwyn Jones, Harley-Davidson, Dodge City, Kan., July 5, 1920. (Two-mile dirt speedway.)

Three Hundred Miles—3:40:04 4-5—Made by Jim Davis, Harley-Davidson, Dodge City, Kan., July 5, 1920. (Two-mile dirt speedway.)

SIDECAR, 61 CUBIC INCHES

One Mile—1:13 3-5—Made by Lester Foote, Harley-Davidson, Greeley, Col., Sept. 17, 1920. (Half mile dirt track.)

Two Miles—1:49 1-5—Made by Jiggs Price, Harley-Davidson, Readville, Mass., Oct. 23, 1920. (Mile dirt track.)

Five Miles—4:35 3-5—Made by Jiggs Price, Harley-Davidson, Cleveland, Ohio, Sept. 19, 1920. (Mile dirt track.)

Ten Miles—8:15 3-5—Made by Sam Riddle, Indian, Sheepshead Bay, N. Y., Oct. 11, 1919. (Two-mile board speedway.)

Twenty-five Miles—20:36 2-5—Made by Teddy Carroll, Indian, Sheepshead, Bay, N. Y., Oct. 11, 1919. (Two-mile board speedway.)

NON-COMPETITIVE RECORDS

STRAIGHTAWAY RECORDS

(Made under M. & A. T. A. Sanction)

Made at Daytona Beach, Fla., in 1920, not in competition. Both professional and amateur classifications. All electrically timed and checked and certified.

# of American Motorcycles for 1921.

FRAME AND WHEELS								MISCELLANEOUS											
Wheel-base (In.)	Frame Type	Front Forks Type	Tires Size (In.)	Type of Springs		Road Clearance Exclusive of Pedals (In.)	Height of Saddle Above Ground (In.)	Starting System	Lighting System	Brakes: Type and Number	Gas Tank Capacity, Gals.	Oil Tank Capacity Qts.	Weight		Speed			List Price Net Equipped	List Price, Equipped
				Front	Rear								Empty (Lb.)	Ready for Road (Lb.)	Record High (m.p.h.)	Normal High (m.p.h.)	Lowest (m.p.h.		
56	Diamond	Helical Spring	26x3	Helical		4	28	Kick	None	1 External	2¼	None	180	200				$275	
59	Loop	Helical Spring	28x3	Helical			30	Kick	Split. Gem	2 Internal and External			361	387	100	65	6	$435	$485
60	Loop	Helical Spring	28x3	Helical		5	30½	Kick	None	1 External 1 Inter-Opt.	3	4½	340	365	103	65	4	$450	
60	Loop	Helical Spring	28x3	Helical		5	30½	Kick	Own Gen. Exide Bat.	1 External 1 Inter-Opt.	3	4½	360	385	103	65	4		$485
53½	Diamond	Helical Spring	28x3	Helical		5½	28	Kick	None	1 External 1 Inter-Opt.	3	2½	260	280		55	4	$415	
53½	Diamond	Helical Spring	28x3	Helical		5½	28	Kick	Own Gen. Exide Bat.	1 External 1 Inter-Opt.	3	2½	280	300		55	4		$445
60	Loop	Helical Spring	28x3	Helical		5	30½	Kick	None	1 Internal 1 Exter-Opt.	3	4½	345	370		70	4	$485	
60	Loop	Helical Spring	28x3	Helical		5	30½	Kick	Own Gen. Exide Bat.	1 Internal 1 Exter-Opt.	3	4½	365	390		70	4		$520
54¼	Loop	Leaf Spring	26x3	Leaf		4¾	28	Kick	Split-Gen. Witherbee Battery	1 Internal	3	3		275		55	7	$400	$440
59½	Loop & Cradle Springs	Leaf Spring	28x3	Leaf		6¼	32⅜	Kick	Split-Gen. Witherbee Battery	1 Internal 1 External	3¼	3		351	115	65	9	$440	$480
60	Double Loop	Helical Spring	27x3½	Helical		5¼	29	Kick	Split-Gen.	1 Internal 1 External	3	3	392	421	75	65	4	$535	$600
58	Loop	Leaf Spring	28x3	Leaf		5	29½	Kick	None	1 External	2½	2		260				$320	
58	Loop	Leaf Spring	28x3	Leaf		5	29½	Kick	None	1 External	2½	2		260				$290	
58	Loop	Leaf Spring	28..3	Leaf		5	29½	Kick	None	1 External	2½	2		220				$250	
58	Loop	Leaf Spring	28x3	Leaf		5	29½	Kick	None	1 External	2½	2		220				$225	
58	Loop	Leaf Spring	28x2½	Leaf		5	31½	Pedals	None	Coaster Hub	2	1½		215				$200	
58	Diamond	Helical Spring	28x3	Helical		5½	31	Kick		1 Internal 1 External	3¼	3	343					$435	
58	Diamond	Helical Spring	28x3	Helical		5½	31	Kick	Split-Gen.	1 Internal 1 External	3¼	3	366						$475

PROFESSIONAL, SOLO 61

(8-Valve Motors)—By Gene Walker, Indian, April 14-15, 1920. Kilometer—19:32 sec. One mile—31:53 sec. Two miles—1:04:45. Five miles—2:45:62.

Both Ways of Course—Kilometer—22:16 North; 21:04 South; 21:60 average. One mile—35:78 North; 33:62 South; 34:70 average.

PROFESSIONAL, SOLO 61

(Pocket Valve Motors)—By Gene Walker, Indian, April 14-15, 1920. Kilometer—21:15 sec. One mile—34:20 sec. Two miles—1:09:71. Five miles—3:04:70.

Both Ways of Course—Kilometer—23:83 North; 22:11 South; 22:96 average. One mile—38:00 North; 34:92 South; 22:96 average.

PROFESSIONAL, SOLO 30.50

(4-Valve Motors)—By Gene Walker, Indian, April 14-15, 1920. Kilometer—25:80 sec. One mile—40:98 sec. Two miles—1:23:03. Five miles—3:30:11.

Both Ways of Course—Kilometer—28:30 North; 26:12 South; 27:21 average. One mile—45:63 North; 42:08 South; 43:85 average.

PROFESSIONAL, SIDECAR 61

(8-Valve Motors)—By Leslie Parkhurst, Harley-Davidson, Feb. 17, 1920. Kilometer—26:54 sec. One mile—42:81 sec. Two miles—1:25:69. Five miles—3:34:52.

Both Ways of Course—Kilometer—26:54 North; 44:88 South; 43:85 average.

1920 NATIONAL CHAMPIONSHIPS

One Mile, 61—Won by Gene Walker, Indian, Cleveland, Ohio, Sept. 9. Time, 45 2-5 sec.

One Mile, 30:50—Won by Gene Walker, Indian, Akron, Ohio, Aug. 1. Time, 1:06.

One Mile, Sidecar—Won by Lester Foote, Harley-Davidson, Greeley, Colo., Sept. 17. Time 1:13 3-5.

Two Miles, 61—Won by Gene Walker, Indian, Akron, Ohio, Aug. 1. Time, 2:14 3-5.

Two Miles, Sidecar—Won by Jiggs Price, Harley-Davidson, Readville, Mass., Oct. 23. Time, 1:49 1-5.

Five Miles, 61—Won by Gene Walker, Indian, Readville, Mass., Oct. 23. Time, 3:50 4-5.

Five Miles, 30:50—Won by Albert Burns, Indian, Grand Junction, Colo., June 6. Time, 6:02.

Five Miles, Sidecar—Won by Floyd Clymer, Indian, Colorado, July 25. Time, 5:01.

Ten Miles, 61—Won by Ralph Hepburn, Harley-Davidson, Readville, Mass., Oct. 23. Time, 8:03 2-5.

Ten Miles, 30:50—Won by Gene Walker, Indian, Greeley, Colo., May 3. Time, 11:25.

Ten Miles, Sidecar—Won by S. J. Riddle, Indian, Pottstown, Pa., May 3. Time, 10:54.

Twenty-five Miles, 61—Won by Albert Burns, Indian, Ascot, Los Angeles, Cal., Jan. 11. Time, 18:32.

Twenty-five Miles, 30:50—Won by Don Marks, Indian, South Bend, Ind., July 1. Time, 27:00 4-5.

Twenty-five Miles, Sidecar—Won by F. R. Dreyer, Indian, Philadelphia, Pa., June 19. Time, 25:34.

Twenty-five Mile Road Race—Won by Leonard Buckner, Indian, Savannah, Ga., April 26. Time, 40:01.

Fifty Mile Road Race—Won by Gene Walker, Indian, Savannah, Ga., April 26. Time, 40:01.

Two Hundred Mile Road Race—Won by Ray Weishaar, Harley-Davidson, Marion, Ind., Sept. 6. Time 2:48:37:12.

Three Hundred Miles, 61—Won by Jim Davis, Harley-Davidson, Dodge City, Kan., July 5. Time, 3:40:04 4-5.

British Motorcycle

Compiled for Automotive

Number	Name	H.P.	ENGINE						ENGINE BEARINGS		No. of Rings	Engine Lubrication System	Clutch Control	Make of Gearset	No. of Speeds
			Type 2-Stroke or 4-Stroke	Make	No. of Cylinders	Cylinder Arrangement	Bore and Stroke	Cylinder Head Detachable	Crank Shaft	Big-end					
1	A. J. S.	7	4	Own	2	Ve	74x93	Yes	P	R	3	Sp	H	Own	3
2	Allen	2¾	2	Own	1	V	70x76	No	P	P	2	Sp	H	Own	2
3	Armis	2¾	4	J.A.P.	1	V	70x76	No	P	P	2	Sp	H	Burman	2
4	Armis	3½	2	Precision	1	V	74x81	Yes	B	B	2	C-S	H	Burman	2
5	Armis	8	4	J.A.P.	2	Ve	70x85	No	P	P	3	Sp	H	Burman	3
6	Bat	6	4	J.A.P.	2	Ve	76x85	No	P	P	3	Sp	H	Stur. Arch	3
7	Beardmore Precision	3½	2	Own	1	V	74x81	Yes	R	R	3	C-S	H	Own	2
8	Blackburne	4	4	Own	1	V	85x88	Yes	P	P	2	Sp	H	Stur. Arch	3
9	Blackburne	8	4	Own	2	Ve	85x88	Yes	B	R	2	Sp	H	Burman	3
10	Bradbury	2¾	4	Own	1	V	74.5x80	Yes	B	P	3	Sp	H	Own	2
11	Bradbury	4	4	Own	1	V	89x89	No	B	P	2	Sp	H	Own	3
12	Bradbury	6	4	Own	2	V	74.5x86	Yes	B	P	3	Sp	F	Own	3
13	Brough	3½	4	Own	2	H	70x64.5	No	R	R	2	Sp	H	Stur. Arch	3
14	Brough	5	4	Own	2	H	70x90	No	R	R	2	Sp	H	Stur. Arch	3
15	B. S. A.	4¼	4	Own	1	V	85x98	No	B	R	2	Sp	F	Own	3
16	B. S. A.	6	4	Own	2	Ve	76x85	No	B	R	2	Sp	H	Own	3
17	Clyno	8	4	Own	2	Ve	76x102	Yes	P	R	3	Sp	F	Own	3
18	Connaught	2½	2	Own	1	V	70x73	No	P	P	3	F		None	1
19	Connaught	2¾	2	Own	1	V	70x73	No	P	P	3	F	H	Stur. Arch	2
20	Coulson	2¾	4	Blackburne	1	V	71x88	Yes	P	P	2	Sp	H	Stur. Arch	3
21	Coulson	4	4	Blackburne	1	V	85x88	Yes	P	P	2	Sp	H	Stur. Arch	3
22	Diamond	2½	2	Villiers	1	V	70x70	No	P	R	3	Sp	H	Stur. Arch	2
2	Diamond	2½	4	J.A.P.	1	V	70x76	No	P	P	2	Sp	H	Stur. Arch	2
24	Dot	3½	4	J.A.P.	2	Ve	70x64	No	P	P	2	Sp	H	Albion	2
25	Dot	8	4	J.A.P.	2	Ve	85x85	No	P	P	2	Sp	H	Stur. Arch	3
26	Douglas	2¾	4	Own	2	H	61x60	No	B	P	2	Sp		Own	2
27	Douglas	2¾	4	Own	2	H	61x60	No	B	P	2	Sp	H	Own	2
28	Douglas	4	4	Own	2	H	74.5x68	No	B	P	2	Sp	F	Own	3
29	Douglas	2¾	4	Own	2	H	61x60	Yes	B	P	2	Sp	H	Own	3
30	Douglas	3½	4	Own	2	H	68x68	Yes	B	P	2	Sp	H	Own	3
31	Dunelt	4½	2	Own	1	Ve	85x88	No	B	P	3	Sp	H	Stur. Arch	3
32	Enfield	8	4	Vickers	2	Ve	85.5x85	No	R	R	3	Sp	H	Own	2
33	Excelsior	2½	2	Villiers	1	V	70x70	No	P	R	3	Sp		Stur. Arch	2
34	Excelsior	2¾	4	Blackburne	1	V	71x88	Yes	P	P	2	Sp	H	Stur. Arch	2
35	Excelsior	4½	4	Own	1	V	86x112	No	P	P	3	Sp	H	Stur. Arch	3
36	Excelsior	6	4	J.A.P.	2	Ve	70x85	No	P	P	2	Sp	H	Stur. Arch	3
37	Francis Barnett	2¾	4	J.A.P.	1	V	70x76	No	P	P	3	Sp	H	Stur. Arch	2
38	Hazlewood	6	4	J.A.P.	2	Ve	70x88	No	B.&P.	P	2	Sp	F	Own	3
39	Hazlewood	8	4	J.A.P.	2	Ve	85x85	No	B.&P.	P	3	Sp	F	Own	3
40	Hobart	2¼	2	Villiers	1	V	70x70	No	P	R	3	Sp	H	Stur. Arch	2
41	Hobart	2¾	4	J.A.P.	1	V	70x76	No	P	P	3	Sp	F	Stur. Arch	2
42	Humber	4½	4	Own	2	H	75x68	No	B	B	2	C-S	H	Own	3
43	Hoskison	2¾	4	Blackburne	1	V	71x88	Yes	P	P	2	Sp	H	Burman	2
44	Hoskison	4	4	Blackburne	1	V	85x88	Yes	P	P	2	Sp	H	Burman	3
45	Imperial	2¾	4	J.A.P.	1	V	70x76	No	P	P	2	Sp	H	Own	2
46	Imperial	8	4	J.A.P.	2	Ve	85x85	No	B.&P.	P	2	Sp	H	Own	3
47	James	2¼	2	Own	1	V	66x70	No	P	R	3	Sp	H	None	2
48	James	3½	4	Own	2	Ve	64x77	No	B	R	2	Sp	H	Own	3
49	James	4¼	4	Own	1	V	86x103	No	B	P	2	Sp	F	Own	3
50	James	7	4	Own	2	Ve	73x90	No	B	R	2	Sp	F	Own	3
51	J. E. S.	2	2	Own	1	V	60x60	No	P	P	3	Sp		None	1
52	J. E. S.	1½	4	Own	1	V	55x60	Yes	P	P	2	Sp		None	1
53	Levis	2¼	2	Own	1	V	62x70	No	P	P	2	H-S		None	1
54	L. M. C.	6	4	Own	2	Ve	79x85	No				Sp shaft	H	Stur. Arch	3
55	L. M. C.	8	4	Own	2	Ve	79x98	No				Sp	H	Stur. Arch	3
56	Matchless	8	4	J.A.P.	2	Ve	85x85	No	P	P	3	Sp	H	Own	3
57	Metro Tyler	2¼	2	Own	1	V	70x70	No	B	R	2	Sp		Own	2
58	Norton	3½	4	Own	1	V	79x100	No	R	R	2	Sp		None	1
59	Norton	3½	4	Own	1	V	79x100	No	R	R	2	Sp	H	Stur. Arch	3
60	Norton	4	4	Own	1	V	82x120	No	R	R	2	Sp	H	Stur. Arch	3
61	Nut	3½	4	Own	2	V	64.5x76	No	B	R	2	C-S	H	Stur. Arch	3
62	Nut	3½	4	Own	2	Ve	64.5x76	Yes	P	R	2	C-S	H	Stur. Arch	3
63	Nut	5	4	Own	2	Ve	70x88	No	B	P	2	C-S	H	Stur. Arch	3
64	Olympic	2¾	2	Orbit	1	V	68x72	No	P	P	2	Sp	H	Jackes	2
65	P. & M.	3½	4	Own	1	I	84.5x88.9	No	B	P	2	Sp	H	Own	2
66	Quadrant	4½	4	Own	1	V	87x95	No	B	P	2	Sp	H	Stur. Arch	3
67	Quadrant	5	4	Own	1	V	87x110	No	B	P	2	Sp	H	Stur. Arch	3
68	Radico	2½	2	Own	1	V	67x70	No	P	P	2	Sp		Albion	2
69	Raleigh	6	4	Own	2	H	77x75	Yes	R	R	2	Sp	H	Stur. Arch	3
70	Rover	3½	4	Own	1	V	85x88	No	B	R	2	Sp			1
71	Rover	3½	4	Own	1	V	85x88	No	P	R	2	Sp	F	Own	3
72	Rover	6	4	J.A.P.	2	Ve	70x85	No	P	P	2	Sp	F	Own	3
73	Ruby	2¾	4	Own	1	V	74.5x80	No	P	P	3	Sp	H	Own	2
74	Ruby	3	4	Own	1	V	74.5x86	No	P	P	2	Sp	H	Own	2
75	Ruby	8	4	J.A.P.	2	Ve	85x85	No	P	P	3	Sp	H	Stur. Arch	3
76	Rudge	3½	4	Own	1	V	85x88	No	B	P	2	Sp	H		Var.
77	Rudge	5	4	Own	1	V	85x132	No	B	P	2	Sp	H		Var.
78	Rudge	7	4	Own	2	Ve	85x88	No	B	P	2	Sp	H		Var.
79	Rudge	7	4	Own	2	Ve	85x88	No	B	P	2	Sp	H	Own	3
80	Scott	3¼	2*	Own	2	V	73x63.5	No	R	R	3	Sp	H	Own	2
81	Sun	2¾	2	Own	1	V	70x70	No	R	R	2	F-F	H	Stur. Arch	2
82	Sunbeam	3½	4	Own	1	V	85x88	No			1 & S	Sp	H	Own	3
83	Sunbeam	8	4	J.A.P.	2	Ve	85x85	No			1 & S	Sp	H	Own	2
84	Superb Four	10	4	Own	4	V	63x78	Yes	P	P	2	C-S	F	Own	3
85	Triumph	2¼	2	Own	1	V	64x70	No	P	P	3	F		Own	2
86	Triumph	4	4	Own	1	V	85x97	No	B	R	3	Sp	H	Stur. Arch	3
87	Triumph	4	4	Own	1	V	85x97	No	B	R	3	Sp	H	Own	3
88	Velocette	2¼	2	Own	1	V	62x73	No	P	P	2	H-S		Own	2
89	Wilkin	2¾	4	Blackburne	1	V	71x88	Yes	P	P	2	Sp		Stur. Arch	3
90	Wilkin	3½	4	Blackburne	1	V	85x88	Yes	P	P	2	Sp	H	Stur. Arch	3
91	Wolf	2½	2	Villiers	1	V	70x70	No	P	R	3	Sp	H	Stur. Arch	2
92	Wolf	2¾	4	J.A.P.	1	V	70x76	No	P	P	3	Sp	H	Stur. Arch	2
93	Wolf	2¾	4	Blackburne	1	V	71x88	Yes	P	P	2	Sp	H	Stur. Arch	2
94	Wolf	4	4	J.A.P.	1	V		No	P	P	3	Sp	H	Stur. Arch	3
95	Wooler	2¾	4	Own	2	H	60.5x60	Yes	B	B	2	C-S	F	Own	3
96	Wooler	2¾	4	Own	2	H	60.5x60	Yes	B	B	2	C-S			Var.
97	Zenith	2¾	4	Bradshaw	2	H	58x65	No	B	P	2	Sp		None	Var.
98	Zenith	5	4	J.A.P.	2	Ve	70x85	No	B.&P.	P	3	Sp		None	Var.
99	Zenith	6	4	J.A.P.	2	Ve	76x85	No	B.&P.	P	3	Sp		None	Var.
100	Zenith	8	4	J.A.P.	2	Ve	85x85	No	B.&P.	P	3	Sp		None	Var.

Aluminum pistons—Nos. 52, 62—All others cast iron. Overhead valves—13, 29, 30, 62, 84. Superimposed valves—52, 76, 77, 78, 79, 95, 96. Electric lighting—61. Floating piston pin—42, 61, 62, 63. Piston pin fixed in rod—7, 17, 52, 69, 70, 71, 73, 74, 90, 93. Expanding clutches—7, 32, 65, 80. Cone clutches—56, 64, 84, 100. Dog clutches—47. Unit power plants—7, 28, 57, 84, 85, 95. Frames spring at rear—6, 7, 17, 20, 21, 56, 69, 74, 75, 95, 96. Detachable and interchangeable wheels—1, 6, 9, 16, 17, 31, 36, 56, 69, 76, 79, 82, 83, 84. Selective gear shift—6. Crank and fenders part of frame—7. Two primary transmission chains—32. Two exhaust valves per cylinder—61.

Specifications for 1921

Industries by M. W. Bourdon

GEAR RATIOS			Type of Transmission	Width of Belt	MUDGUARDS		Ground Clearance	BRAKES, TYPE		Type and Wheel Size	Weight, Solo Machine	TANK CAPACITY		Foot-boards or Footrests	Number	Name
Top	2nd	Low			Width	Clearance		Front	Rear			Fuel, Pints	Oil, Pints			
5	9	16	Ch.	....	7	3	6	Exp.	Exp.	28x3	.....	18	3	B.	1	A. J. S.
5¼	.....	9	Ch. & B.	¾	4	1½	4¼	Exp.	Exp.	26x2¼	190	12	3	B.	2	Allon
5	.....	9.5	Ch. & B.	¾	4¼	1½	5½	Rim.	Belt rim.	26x2¼	170	12	3	B.	3	Armis.
5	.....	9.5	Ch. & B.	¾	4¼	1½	5½	Rim.	Belt rim.	26x2¼	180	12	3	B.	4	Armis.
.....	.....	.....	Ch. & B.	1	6	2½	5½	Rim.	Belt rim.	26x2½	220	12	3	B.	5	Armis.
4.6	8	11	Ch.	....	4	1¾	6	.....	Exp. & Cont.	28x3	300	16	4	B.	6	Bat
5	.....	9	Ch.	....	4½	1¾	5½	Cont.	Cont.	26x2¼	230	16	2	B.	7	Beardmore Precision
.....	.....	.....	Ch.	....	6	2	5½	Rim.	Cont.	28x3	250	16	4	O.	8	Blackburne
.....	.....	.....	Ch.	....	6	2	6	Rim.	Exp.	28x3	330	16	4	B.	9	Blackburne
5.1	.....	10	Ch. & B.	....	3½	1½	5	Rim.	Belt rim.	26x2¼	240	12	3	B.	10	Bradbury
5.1	8.4	14.8	Ch.	....	3¼	1½	5	Rim.	Exp.	26x2½	280	12	3	B.	11	Bradbury
5.1	8.4	14.8	Ch.	....	3¼	1½	6	Rim.	Exp.	26x2½	325	18	3	B.	12	Bradbury
4¼	5½	8½	Ch.	....	4	1¼	6½	Exp.	V rim.	26x2½	196	14	3	R.	13	Brough
4½	7½	12	Ch.	....	5	1¼	6½	Exp.	V rim.	26x2½	255	18	3	O.	14	Brough
5	8	12.8	Ch.*	....	.....	.....	.....	V rim.	V rim.	26x2½	238	16	2½	B.	15	B. S. A.
5	8.2	13.2	Ch.	....	.....	.....	.....	V rim.	Exp.	28x3	336	17	3½	B.	16	B. S. A.
4.9	7.6	16	Ch.	....	8	3	6	Rim.	Exp.	28x3	.....	18	3	B.	17	Clyno
5	.....	.....	B.	¾	4	1¾	4½	Rim.	Belt rim.	24x2	170	8	2	R.	18	Connaught
5½	.....	10½	Ch. & B.	¾	4	1¾	4½	Rim.	Belt rim.	26x2¼	180	10	2	B.	19	Connaught
5	8	13	Ch. & B.	¾	5	1½	4½	.....	2 bands.	26x2½	191	12	3	B.	20	Coulson
5	8	13	Ch. & B.	1	5½	1½	4½	.....	2 bands.	26x2½	.....	12	3	B.	21	Coulson
6	.....	10.6	Ch. & B.	¾	5	1¾	5	Rim.	Belt rim.	26x2¼	167	16	2	R.	22	Diamond
6	.....	10.6	Ch. & B.	¾	5	1¾	5	Rim.	Belt rim.	26x2¼	168	16	2	O.	23	Diamond
4.5	.....	9	Ch. & B.	⅞	5	2¼	4½	Rim.	Belt rim.	26x2¼	196	12	2	B.	24	Dot
4¾	9	12½	Ch.	....	7	2½	6	Rim.	Exp.	28x3	280	20	3	B.	25	Dot
6.1	.....	8.5	Ch. & B.	¾	8	2½	7	Rim.	Belt rim.	26x2¼	175	10	3	R.	26	Douglas
6.1	8.5	13	Ch. & B.	¾	8	2½	7	Rim.	Belt rim.	26x2¼	200	10	3	R.	27	Douglas
5	8	12	Ch. & B.	⅞	8	2½	6	Rim.	Belt rim.	26x2½	250	16	3	B.	28	Douglas
.....	.....	.....	Ch.	....	5	2½	5	V drum.	Exp.	26x2½	240	12	3	R.	29	Douglas
.....	.....	.....	Ch.	....	5	2½	5	V drum.	Exp.	26x2½	260	12	3	R.	30	Douglas
4½	8	12½	Ch. & B.	1	6	2	6½	Rim.	Belt rim.	26x2½	260	18	3	B.	31	Danelt
5	.....	9	Ch.	....	6	2½	5	V rim.	V rim.	28x3	320	16	3	B.	32	Enfield
.....	.....	.....	Ch. & B.	¾	3	1½	5	Rim.	Belt rim.	26x2¼	.....	.....	.....	B.	33	Excelsior
.....	.....	.....	Ch. & B.	¾	5	2	5	Rim.	Belt rim.	26x2¼	.....	.....	.....	B.	34	Excelsior
.....	.....	.....	Ch. & B.	1	5	2	5	Rim.	Belt rim.	26x2½	.....	.....	.....	B.	35	Excelsior
.....	.....	.....	Ch.	....	5	2	5	Rim.	Exp.	28x3	.....	.....	.....	B.	36	Excelsior
6	.....	10	Ch. & B.	¾	3¼	1¼	4	Rim.	Belt rim.	26x2¼	188	16	3	B.	37	Francis Barnett
4	7	13	Ch. & B.	1	8	2½	5	Rim.	Belt rim.	28x2½	200	16	4	B.	38	Hazlewood
4¼	7	13	Ch. & B.	1	8	3	5½	Rim.	Belt rim.	26x3	230	20	6	B.	39	Hazlewood
5¼	.....	11	Ch. & B.	¾	6	2	5	V rim.	Belt rim.	26x2¼	164	12	3	B.	40	Hobart
5¼	.....	11	Ch. & B.	¾	6	2	5	V rim.	Belt rim.	26x2¼	175	12	3	B.	41	Hobart
5	8.5	14	Ch.	....	4¾	1½	5	Rim.	V rim.	26x2½	275	18	2	B.	42	Humber
5.4	.....	9.25	Ch. & B.	¾	7¼	1⅝	5¼	V rim.	Belt rim.	26x2¼	183	12	2	B.	43	Hoskison
5.1	8.3	12.2	Ch. & B.	1	7¼	1⅝	5¼	V rim.	Belt rim.	26x2½	248	20	2	B.	44	Hoskison
5¼	.....	11	Ch. & B.	¾	7	3	5	Rim.	Belt rim.	26x2¼	165	12	2	B.	45	Imperial
4½	8½	12½	Ch.	....	7	3	6	Rim.	Vee rim.	28x3	315	16	4	B.	46	Imperial
5½	.....	10	Ch. & B.	¾	5	2½	5	Rim.	V rim.	26x2¼	168	8	2	B.	47	James
5	8½	13	Ch.	....	5	2½	5	Rim.	V rim.	26x2½	232	16	2	B.	48	James
5	8½	13	Ch.	....	7	3	6	Rim.	Exp.	28x3	280	16	2	B.	49	James
5	8½	13	Ch.	....	7	3	6	Rim.	Exp.	28x3	296	16	2	B.	50	James
6	.....	.....	B.	⅝	3	1½	.....	Rim.	Belt rim.	26x1¾	80	8	2	B.	51	J. E. S.
8	.....	.....	B.	½	3	1½	.....	Rim.	Cont.	26x1¾	75	6	1	P.	52	J. E. S.
5¼	.....	.....	B.	¾	3	1¼	5	Rim.	Belt rim.	24x2	110	10	2	R.	53	Levis
4	7	12	Ch. & B.	1	5	2	4½	Rim.	Belt rim.	26x2½	.....	12	3	B.	54	L. M. C.
4	7	12	Ch.	....	5	2	4½	V rim.	Exp.	26x2½	.....	12	3	.....	55	L. M. C.
.....	.....	.....	Ch.	....	5	3	6	Rim.	Exp.	28x3	320	16	6	B.	56	Matchless
5.8	.....	11	Ch. & B.	⅞	6	2	4½	Rim.	Belt rim.	26x2¼	180	12	2	R.	57	Metro Tyler
3½	.....	6	B.	1	5	1½	3½	Rim.	Belt rim.	26x2¼	197	12	3	R.	58	Norton
4½	7¾	13¼	Ch.	....	5	2	3¾	Rim.	V rim.	26x2½	252	16	3	R.	59	Norton
4½	7¾	13¼	Ch.	....	7	3	6	Rim.	V rim.	26x2½	285	16	3	B.	60	Norton
4.5	7.3	12	Ch. & B.	1	5	2½	5	Rim.	Belt rim.	26x2½	265	16	4	R.	61	Nut
4.2	5.3	8	Ch. & B.	1	3½	2	4	Rim.	Belt rim.	26x2½	.....	16	8	R.	62	Nut
4.5	7.3	12	Ch. & B.	1	5	2½	5	Rim.	Belt rim.	26x2½	285	16	4	R.	63	Nut
5¾	.....	10	Ch. & B.	¾	7	2	6	Rim.	Belt rim.	26x2¼	180	16	4	B.	64	Olympic
5.4	.....	9.5	Ch.	....	5	2¾	5½	V rim.	Cont.	26x2½	265	12	3	R.	65	P. & M.
5	8	13	Ch. & B.	1	6¾	2¼	5	Rim.	Belt rim.	26x2½	260	18	4	B.	66	Quadrant
5	8	13	Ch. & B.	1	6¾	2¼	5	Rim.	Belt rim.	26x2½	270	18	4	B.	67	Quadrant
5	.....	9¼	Ch. & B.	¾	3	1½	4	Rim.	Belt rim.	24x2	128	11	3	B.	68	Radico
5	7.5	13.2	Ch.	....	5	1¾	6	V rim.	Exp.	26x2½	295	18	3	B.	69	Raleigh
3.7	.....	7	B.	⅞	4½	1½	4½	V rim.	Belt rim.	26x2½	220	16	2	R.	70	Rover
4.5	7.6	14.2	Ch.	....	6	2	4½	V rim.	Exp.	26x2½	270	16	2	B.	71	Rover
4.9	8.2	15.4	Ch.	....	6	2	6	V rim.	Exp.	28x3	280	16	2	B.	72	Rover
5¼	.....	10	Ch. & B.	¾	5	1¾	6	Rim.	Belt rim.	26x2¼	180	12	3	R.	73	Ruby
5¼	.....	10	Ch. & B.	¾	6½	1¾	6	Rim.	Belt rim.	26x2½	230	12	3	B.	74	Ruby
5	8	14	Ch.	....	8½	2	6	Rim.	Exp.	28x3	280	16	4	B.	75	Ruby
3½	.....	7	B.	1	5	1¾	5½	Rim.	Belt rim.	26x2½	240	18	3	R.	76	Rudge
3½	.....	7	B.	1	5	2	4	Rim.	Belt rim.	26x2½	246	18	3	R.	77	Rudge
3½	.....	7	B.	1	5	1¾	5½	Rim.	Belt rim.	26x2½	260	18	3	R.	78	Rudge
4	6.8	9.7	Ch.	....	5	1¾	5½	V rim.	V rim.	26x2½	290	18	3	B.	79	Rudge
4.26	.....	7.84	Ch.	....	5½	2	5	Rim.	Exp. drum.	26x2½	227	16	2	B.	80	Scott
5	.....	9.5	Ch. & B.	¾	7	2½	5	Rim.	Belt rim.	26x2¼	.....	10	2	B.	81	Sun
5	8	13	Ch.	....	.....	.....	.....	Rim.	Exp.	26x2½	.....	.....	.....	B.	82	Sunbeam
4.6	7.3	12.6	Ch.	....	.....	.....	.....	Rim.	Exp.	28x3	.....	.....	.....	B.	83	Sunbeam
.....	.....	.....	Ch.	....	6	3	6	.....	2 exp.	28x3	.....	.....	.....	B.	84	Superb Four
6	.....	10	B.	¾	.....	.....	4½	Rim.	Belt rim.	24x2¼	130	9	2	R.	85	Triumph
5	8¾	13½	Ch. & B.	1	.....	.....	4	Rim.	Belt rim.	26x2½	230	12	2	R.	86	Triumph
4¾	8	13½	Ch.	....	.....	.....	.....	Rim.	V rim.	26x2½	240	12	2	R.	87	Triumph
5.3	.....	9.3	Ch.	....	6	2	5	Rim.	Exp.	24x2¼	160	9	3	B.	88	Velocette
5¼	8	11	Ch.	....	7	2½	5	Rim.	V rim.	26x2¼	220	16	3	R.	89	Wilkin
5	9	14	Ch.	....	7	2½	5½	Rim.	V rim.	26x3	228	16	3	O.	90	Wilkin
.....	.....	.....	Ch. & B.	¾	4	1¾	5½	Rim.	Belt rim.	26x2¼	160	8	3	O.	91	Wolf
.....	.....	.....	Ch. & B.	¾	4	1¾	5½	Rim.	Belt rim.	26x2¼	175	8	3	O.	92	Wolf
.....	.....	.....	Ch. & B.	¾	5	2	5½	Rim.	Belt rim.	26x2¼	195	8	3	O.	93	Wolf
.....	.....	.....	Ch. & B.	¾	5	2	5½	Rim.	Belt rim.	26x2½	.....	10	3	B.	94	Wolf
.....	.....	.....	Ch.	¾	5	2	6	Cont.	V rim.	26x2¼	165	16	3	O.	95	Wooler
.....	.....	.....	B.	⅞	5	2	6	Cont.	Belt rim.	26x2½	160	16	3	O.	96	Wooler
6	.....	13*	Ch. & B.	⅞	5	2	3¾	Rim.	Belt rim.	26x2¼	.....	12	3	R.	97	Zenith
3.3	.....	7.3*	B.	1	5	2	4½	Rim.	Belt rim.	26x2½	254	12	4	R.	98	Zenith
3.3	.....	7.3	B.	1	5	2	5¼	Rim.	Belt rim.	28x3	274	16	4	R.	99	Zenith
4	.....	11	Ch. & B.	1½	5	2	5	V rim.	Belt rim.	28x3	318	16	4	R.	100	Zenith

Water cooled engine—80. **Cylinder Arrangement:** V—Vertical; Ve—Vee; H—Horizontal; I—Inclined. **Engine Bearings:** P—Plain; B—Ball; R—Roller. **Engine Lubrication System:** Sp—Splash; C-S—Circulating Splash; F—Oil mixed with fuel; H-S—Hollow Shaft; F-F—Forced Feed. **Clutch Control:** H—Hand; F—Foot. **Type of Transmission:** Ch—Chain; B—Belt; *—Chain & Belt Optional. **Foot Boards or Footrest:** B—Foot Boards; R—Foot Rests; O—Optional; P—Pedals.

Summary of British Motorcycle Specifications

By M. W. Bourdon

See table on page 374

Number of Cylinders
Four .....1 only
Three .....1 only
Remainder:
1-cylinder .....57 per cent
*2-cylinder .....43 per cent

*25 per cent horizontally opposed.

Engine Type
Four-cycle .....80 per cent
Two-cycle .....20 per cent
Up to 2¾ hp.:
Four-cycle .....55 per cent
Two cycle .....45 per cent

Cylinder Heads
Integral .....76 per cent
Detachable .....24 per cent

Valve Location
Side .....68 per cent
Valveless .....20 per cent
Both overhead.... 6 per cent
Inlet overhead.... 6 per cent

Crankshaft Bearings
Plain .....45 per cent
Ball .....36 per cent
Roller .....13 per cent
Ball and plain.... 6 per cent

Big-End Bearings
Plain .....61 per cent
Roller .....36 per cent
Ball ..... 3 per cent

Piston Material
Cast iron .....98 per cent
Aluminum ..... 2 per cent

Number of Rings
Three .....65 per cent
Two .....35 per cent

Wrist Pin
Fixed in piston...81 per cent
Fixed in rod.....15 per cent
Floating ..... 4 per cent

Lubrication
Splash .....73 per cent
Circulating splash.20 per cent
With fuel..... 5 per cent
Forced ..... 2 per cent

Clutches
Plate .....95 per cent
Miscellaneous .... 5 per cent

Clutch Control
Hand .....86 per cent
Foot .....14 per cent

Number of Gear Changes
1-speed ..... 7 per cent
2-speeds .....32 per cent
3-speeds .....54 per cent
Variable belt pulley 7 per cent

Gearset Mounting
Separate .....91 per cent
Unit with engine.. 9 per cent

Transmission
Chain and belt ...48 per cent
Chain .....40 per cent
Belt only .....12 per cent

(*Continued on page 377*)

Motorcycle Exports

	1913	1914	1915	1916	1917	1918	July 1 Dec. 31 1918	Calendar Year 1919	1920	Total for All Years
Europe:										
Austria-Hungary		*29*	7					*8*		*44*
		$5,875	$1,535					$1,620		$9,030
Azores, and Madeira Islands				*1*				*2*	*21*	*24*
				$228				$500	$6,797	$7,525
Belgium	*25*	*65*	*1*					*571*	*1,053*	*1,665*
	$5,176	$11,803	$151					$143,231	$323,344	$483,705
Bulgaria									*1*	*1*
									$108	$108
Denmark	*38*	*239*	*149*	*784*	*757*	*2*	*11*	*1,981*	*741*	*4,00#*
	$6,269	$43,325	$24,163	$128,186	$135,787	$650	$3,850	$348,265	$208,406	$898,901
Finland	*21*	*78*						*149*	*259*	*507*
	$4,479	$13,798						$38,015	$80,516	$136,808
France	*39*	*132*	*56*	*216*	*78*	*90*		*272*	*672*	*1,555*
	$8,043	$29,663	$11,573	$36,121	$14,562	$20,946		$84,421	$164,406	$369,735
Germany	*96*	*231*	*2*						*5*	*334*
	$17,525	$48,201	$597						$1,227	$67,550
Gibraltar	*2*				*3*					*5*
	$338				$495					$833
Greece		*15*	*4*	*1*	*1*	*1*		*16*	*18*	*55*
		$2,230		$868	$293	$400		$5,064	$5,447	$14,302
Iceland, and Faroe Islands						*8*	*10*	*22*		*40*
						$2,000	$2,755	$7,048		$11,803
Italy	*115*	*342*	*121*	*790*	*1,666*	*1,940*	*562*	*1,069*	*2,281*	*$8,886*
	$23,298	$70,054	$24,190	$147,223	$349,667	$464,661	$121,578	$296,584	$652,450	$2,149,705
Malta, Gozo and Cyprus Islds.									*24*	*24*
									$6,210	$6,210
Netherlands	*18*	*89*	*348*	*998*	*1,224*			*2,656*	*5,181*	*10,514*
	$4,570	$17,885	$67,962	$190,512	$237,008			$716,681	$1,433,854	$2,688,472
Norway	*8*	*40*	*114*	*227*	*758*	*86*	*80*	*1,787*	*1,828*	*4,928*
	$805	$8,009	$20,656	$41,943	$162,126	$21,414	$19,870	$518,472	$517,432	$1,310,727
Poland and Danzig									*25*	*25*
									$12,288	$12,288
Portugal	*16*	*89*	*91*	*197*	*241*	*222*	*125*	*341*	*228*	*1,550*
	$3,424	$19,014	$18,609	$41,031	$57,981	$56,045	$27,821	$103,882	$74,350	$402,157
Roumania									*4*	*4*
									$1,644	$1,644
Russia in Europe	*85*	*408*	*649*	*2,103*	*14*					*3,259*
	$17,819	$75,505	$137,771	$494,338	$1,679					$727,112
Spain	*40*	*76*	*122*	*206*	*703*	*426*	*226*	*1,079*	*1,416*	*4,294*
	$9,220	$16,443	$21,472	$36,040	$146,398	$90,162	$58,550	$293,332	$457,841	$1,129,458
Sweden	*14*	*179*	*90*	*457*	*1,059*	*73*		*2,651*	*5,888*	*10,411*
	$3,162	$34,106	$18,556	$88,325	$245,062	$13,071		$776,120	$1,671,765	$2,850,167
Switzerland		*5*	*6*			*2*		*145*	*591*	*749*
		$1,229	$1,327			$393		$41,590	$161,020	$205,559
Turkey in Europe	*1*							*80*	*39*	*70*
	$262							$7,405	$12,036	$19,703
England	*1,036*	*1,604*	*324*	*3,797*	*287*	*28*		*1,158*	*2,783*	*11,017*
	$203,734	$320,009	$578,836	$732,582	$61,710	$5,706		$326,307	$786,419	$3,015,303
Scotland	*4*	*16*	*33*	*109*				*14*	*117*	*293*
	$828	$3,284	$8,393	$21,900				$3,747	$35,786	$73,938
Ireland				*50*				*3*	*2*	*55*
				$10,738				$395	$624	$11,757
North America:										
Bermuda				*1*						*1*
				$250						$250
British Honduras						*1*		*1*	*1*	*3*
						$39		$75	$83	$197
Canada	*1,336*	*1,065*	*832*	*927*	*1,064*	*1,041*	*299*	*1,654*	*1,513*	*9,530*
	$236,362	$193,987	$140,015	$148,409	$196,645	$198,739	$65,136	$380,325	$339,350	$1,898,968
Central American States:										
Costa Rica	*6*			*2*	*3*				*5*	*16*
	$1,174			$1,418	$450				$1,542	$4,584
Guatemala	*3*	*5*	*2*	*4*	*31*	*28*		*45*	*41*	*159*
	$671	$1,242	$442	$804	$8,125	$5,033		$13,051	$13,085	$42,453
Honduras			*5*	*4*	*2*	*2*		*3*	*5*	*21*
			$1,159	$330	$400	$575		$961	$1,371	$4,796
Nicaragua				*1*	*2*	*1*	*4*	*6*	*24*	*37*
				$200	$462	$290	$987	$1,860	$7,748	$10,547
Panama	*27*	*32*	*59*	*76*	*61*	*62*	*5*	*30*	*27*	*379*
	$6,238	$7,725	$12,637	$15,387	$15,574	$16,710	$1,037	$8,373	$8,264	$91,945
Salvador	*1*		*3*		*8*	*20*	*12*	*18*	*18*	*80*
	$200		$919		$1,638	$4,458	$3,212	$5,849	$5,815	$22,091
Mexico	*48*	*26*	*8*	*51*	*102*	*59*	*14*	*36*	*61*	*405*
	$9,593	$5,481	$1,897	$9,877	$23,360	$14,622	$3,717	$10,465	$17,829	$96,841
Newfoundland and Labrador	*3*	*8*	*7*	*12*	*5*	*3*		*4*	*1*	*43*
	$717	$1,998	$1,226	$2,505	$1,062	$750		$726	$470	$9,454
West Indies, British:										
Barbados		*6*	*11*	*5*	*11*	*14*	*2*			
		$1,455	$2,585	$757	$2,204	$2,763	$599	*5*	*8*	*62*
Jamaica	*2*	*7*	*8*	*18*	*32*	*30*	*9*	$1,274	$2,999	$14,636
	$500	$1,685	$1,625	$3,080	$4,672	$5,327	$1,524	*15*	*58*	*179*
Trinidad and Tobago		*16*	*14*	*12*	*26*	*14*	*4*	$3,441	$16,947	$38,801
		$4,086	$2,833	$2,506	$5,318	$2,452	$886	*10*	*18*	*114*
Other British				*2*	*10*	*31*		$2,647	$6,043	$26,771
				$480	$1,949	$4,167		*9*	*17*	*69*
Cuba	*43*	*80*	*75*	*66*	*73*	*165*	*50*	$1,884	$4,863	$13,343
	$8,285	$15,980	$13,880	$12,217	$15,076	$36,408	$12,899	*175*	*221*	*948*
Danish (Virgin Is. of U. S.)	*1*	*4*						$46,330	$60,018	$221,093
	$146	$630					*2*	*2*	*3*	*12*
Dominican Republic	*14*	*2*		*12*	*10*	*10*	$405	$457	$966	$2,604
	$2,945	$376		$1,733	$1,173	$1,029	*4*	*21*	*29*	*102*
Dutch	*1*	*1*	*1*		*2*	*3*	$836	$5,412	$9,151	$22,655
	$166	$150	$196		$368	$904		*1*	*1*	*10*
French			*2*		*5*	*4*	*2*	$300	$387	$2,471
			$484		$900	$636	$500	*25*	*1*	*39*
Haiti	*1*				*4*	*14*	*2*	$6,421	$250	$9,191
	$62				$1,015	$4,026	$315	*12*	*9*	*42*
South America:								$3,651	$2,089	$11,158
Argentina	*163*	*110*	*69*	*111*	*173*	*227*	*81*	*437*	*597*	*1,968*
	$30,330	$23,470	$12,798	$20,299	$35,929	$48,655	$19,663	$125,929	$171,615	$488,688

Covering Eight Years

	1913	1914	1915	1916	1917	1918	July 1 Dec. 31, 1918	Calendar Year 1919	1920	Total for All Years
South America—Continued:										
	.....	*1*	.....	*9*	*7*	*11*	.....	*4*	*6*	*38*
Bolivia	.....	$261	.....	$1,606	$1,918	$2,151	.....	$1,560	$1,694	$9,190
	57	*61*	*43*	*78*	*88*	*94*	*18*	*247*	*268*	*954*
Brazil	$12,090	$10,935	$7,743	$9,966	$16,051	$23,387	$4,583	$82,835	$81,485	$249,075
	39	*37*	*2*	*14*	*34*	*88*	*6*	*67*	*130*	*417*
Chile	$8,134	$7,967	$570	$2,406	$6,389	$18,041	$1,572	$17,518	$37,588	$100,185
	4	*9*	*11*	*12*	*11*	*13*	*5*	*8*	*24*	*97*
Colombia	$900	$2,066	$2,359	$2,607	$2,128	$2,472	$740	$2,067	$8,082	$23,421
	2	*6*	*1*	*7*	*13*	*11*	*3*	*10*	*34*	*86*
Ecuador	$436	$852	$135	$1,493	$3,111	$2,216	$798	$2,864	$9,483	$21,388
	2	*8*	*7*	*8*	*30*	*55*	.....	.....	.....	*110*
Guiana, British	$338	$1,523	$1,356	$1,383	$5,047	$8,828	.....	.....	.....	$18,475
	.....	.....	.....	.....	.....	.....	.....	.....	*4*	*4*
Dutch	.....	.....	.....	.....	.....	.....	.....	.....	$1,695	$1,695
	.....	.....	.....	.....	.....	.....	.....	*1*	.....	*1*
French	.....	.....	.....	.....	.....	.....	.....	$120	.....	$120
	.....	.....	.....	*1*	.....	.....	.....	.....	*1*	*2*
Paraguay	.....	.....	.....	$196	.....	.....	.....	.....	$312	$508
	.....	*3*	*3*	*8*	*25*	*5*	*6*	*1*	*18*	*69*
Peru	.....	$632	$847	$1,576	$4,546	$1,103	$1,170	$370	$4,918	$15,162
	15	*10*	.....	*21*	*49*	*26*	*19*	*90*	*133*	*363*
Uruguay	$2,921	$2,409	.....	$4,743	$9,207	$5,892	$4,935	$22,715	$40,767	$93,589
	18	*23*	*4*	*4*	*22*	*2*	*1*	*8*	*8*	*90*
Venezuela	$3,466	$4,725	$912	$456	$4,746	$573	$347	$1,885	$2,384	$19,494
Asia:										
	.....	.....	*2*	*14*	*6*	.....	.....	*6*	.....	*28*
Aden	.....	.....	$246	$2,431	$787	.....	.....	$1,439	.....	$4,903
	18	*20*	*25*	*11*	*92*	.....	*57*	*239*	*157*	*619*
China	$4,542	$4,786	$6,790	$2,562	$16,943	.....	$10,811	$47,883	$49,874	$144,191
	.....	.....	.....	.....	.....	*79*	*1*	*12*	*7*	*99*
Kwantung (leased territory)	.....	.....	.....	.....	.....	$14,172	$200	$2,520	$1,660	$18,552
	6	.....	*2*	*7*	*23*	*10*	*3*	*7*	*19*	*77*
Chosen (Korea)	$1,350	.....	$413	$1,008	$4,852	$2,396	$685	$1,951	$5,283	$17,938
	4	*11*	*4*	*214*	*558*	*16*	.....	*682*	*1,331*	*2,820*
British India	$570	$2,404	$925	$40,388	$111,411	$3,796	.....	$189,108	$381,815	$730,497
	11	*11*	.....	*11*	*82*	*140*	*10*	*106*	*344*	*715*
Straits Settlements	$3,349	$2,116	.....	$1,789	$15,773	$30,899	$2,146	$23,630	$87,415	$167,117
	2	*7*	*3*	*18*	*140*	*68*	.....	*34*	*161*	*433*
Other British East Indies	$591	$1,811	$1,211	$3,050	$26,198	$16,192	.....	$11,393	$48,326	$108,872
	3	*20*	*54*	*185*	*1,079*	*251*	*268*	*634*	*1,283*	*3,777*
Dutch East Indies	$642	$4,916	$11,871	$34,753	$229,167	$50,126	$52,591	$142,007	$371,762	$897,835
	.....	.....	.....	.....	.....	.....	*1*	.....	*14*	*15*
French East Indies	.....	.....	.....	.....	.....	.....	$108	.....	$3,175	$3,283
	.....	*1*	*2*	*23*	*37*	*18*	*14*	*85*	*167*	*275*
Hongkong	.....	$325	$690	$4,353	$7,531	$3,070	$3,549	$24,515	$44,710	$88,743
	137	*21*	*14*	*19*	*122*	*384*	*270*	*864*	*751*	*2,582*
Japan	$25,833	$4,548	$3,597	$3,191	$25,716	$78,324	$64,056	$208,066	$206,806	$620,137
	.....	.....	.....	.....	.....	*2*	.....	.....	.....	*2*
Persia	.....	.....	.....	.....	.....	$730	.....	.....	.....	$730
	.....	*1*	.....	*18*	*21*	.....	.....	.....	*10*	*50*
Russia in Asia	.....	$115	.....	$3,738	$5,380	.....	.....	.....	$2,687	$18,920
	.....	*3*	*6*	*6*	*21*	*17*	*5*	*21*	*19*	*98*
Siam	.....	$648	$1,375	$1,189	$3,626	$3,311	$860	$4,493	$4,864	$20,366
	1	*1*	.....	.....	.....	.....	*2*	*4*	*5*	*13*
Turkey in Asia	$206	$152	.....	.....	.....	.....	$591	$1,564	$1,235	$3,748
Oceania, British:										
	24	*786*	*709*	*2,394*	*2,998*	*1,678*	*1,004*	*2,004*	*2,910*	*14,507*
Australia	$4,706	$132,998	$137,269	$475,157	$634,011	$380,786	$251,433	$570,967	$855,581	$3,442,908
	136	*29*	*333*	*1,576*	*1,108*	*731*	*310*	*1,308*	*2,007*	*7,538*
New Zealand	$22,664	$6,029	$49,072	$282,049	$236,432	$157,432	$79,742	$378,020	$569,741	$1,781,181
	.....	.....	*11*	*10*	*5*	*1*	*3*	*3*	*7*	*40*
Other British	.....	.....	$1,560	$2,120	$1,330	$267	$1,001	$1,023	$2,459	$9,760
	6	.....	.....	.....	*2*	*4*	*3*	*11*	.....	*26*
French	$1,157	.....	.....	.....	$628	$1,186	$513	$2,426	.....	$5,910
	.....	.....	.....	.....	*1*	*1*	.....	.....	*1*	*3*
German	.....	.....	.....	.....	$298	$96	.....	.....	$110	$504
	257	*134*	*135*	*247*	*142*	*163*	*20*	*118*	*200*	*1,416*
Philippine Islands	$42,052	$25,690	$29,383	$51,276	$30,743	$35,725	$4,032	$32,092	$54,119	$305,112
Africa:										
	.....	.....	.....	.....	.....	*1*	.....	.....	*2*	*3*
Belgian Kongo	.....	.....	.....	.....	.....	$289	.....	.....	$530	$819
	.....	*2*	*2*	*72*	*29*	*86*	*21*	*133*	*107*	*452*
British Africa, West	.....	$418	$396	$15,689	$3,575	$12,336	$2,737	$31,570	$29,725	$96,446
	40	*187*	*555*	*1,444*	*1,364*	*1,874*	*129*	*1,786*	*1,536*	*8,915*
South	$6,784	$33,659	$101,210	$204,302	$252,478	$449,846	$36,277	$480,814	$450,325	$2,015,695
	.....	*1*	*6*	*69*	*32*	*155*	*15*	*135*	*27*	*440*
East	.....	$251	$834	$12,210	$5,033	$34,358	$4,500	$39,869	$7,202	$104,257
	.....	*2*	*14*	*9*	*5*	.....	.....	*6*	*18*	*54*
Canary Islands	.....	$493	$2,732	$2,056	$984	.....	.....	$1,666	$5,835	$13,766
	.....	*4*	*2*	*20*	*39*	.....	.....	*44*	*284*	*393*
Egypt	.....	$739	$438	$3,559	$7,251	.....	.....	$14,887	$81,968	$108,842
	.....	.....	.....	.....	*1*	*1*	.....	*17*	*9*	*28*
French Africa	.....	.....	.....	.....	$432	$237	.....	$3,886	$2,091	$6,646
	.....	*1*	*1*	.....	.....	.....	.....	*1*	.....	*3*
German Africa	.....	$201	$473	.....	.....	.....	.....	$175	.....	$849
	.....	.....	.....	.....	.....	.....	.....	.....	*4*	*4*
Kamerun	.....	.....	.....	.....	.....	.....	.....	.....	$968	$968
	.....	.....	.....	.....	*2*	.....	.....	.....	*1*	*3*
Liberia	.....	.....	.....	.....	$300	.....	.....	.....	$207	$507
	.....	.....	.....	*3*	*1*	.....	.....	.....	.....	*4*
Madagascar	.....	.....	.....	$502	$217	.....	.....	.....	.....	$719
	.....	.....	.....	.....	.....	.....	.....	.....	*1*	*1*
Italian Africa	.....	.....	.....	.....	.....	.....	.....	.....	$203	$203
	.....	.....	*1*	.....	*1*	*1*	.....	*6*	*3*	*12*
Morocco	.....	.....	$283	.....	$355	$360	.....	$2,416	$1,050	$4,494
	.....	*11*	*5*	*23*	*4*	*3*	*2*	*17*	*37*	*102*
Portuguese Africa	.....	$1,827	$999	$5,000	$1,034	$520	$565	$5,012	$11,591	$26,548
	.....	.....	.....	*2*	.....	*3*	.....	.....	.....	*5*
Spanish Africa	.....	.....	.....	$575	.....	$638	.....	.....	.....	$1,213
Grand Total Number										*126,313*
Value										$30,963,518

Summary of British Motorcycle Specifications

(*Continued from page* 376)

Frames

Rear rigid .....90 per cent
Rear sprung .....10 per cent

Wheels

*Non-interchangeable .....85 per cent
Interchangeable ..15 per cent
(*15 per cent have knock-out rear spindles.)

Front Brakes

Rim .....76 per cent
V rim .....18 per cent.
Expanding, drum. 4 per cent
Contracting, drum 2 per cent

Rear Brakes

Belt rim .....56 per cent
Expanding, drum.25 per cent
Special V rim.....14 per cent
Contracting, drum. 5 per cent

Motorcycle Wheel Materials

The present S.A.E. Recommended Practice for Motorcycle Spokes and Nipples, specifies a steel slightly different from that of S.A.E. Steel No. 1045.

	Present Specified Composition
% Carbon ...	0.40 to 0.55
% Manganese, min.	0.50
% Phosphorus, max.	0.05
% Sulphur, max.	0.05

S. A. E. Steel No. 1045
0.40 to 0.50
0.50 to 0.80
0.045
0.05

In order to have the specification conform to the standard steel the present recommended practice has been revised to specify S.A.E. Steel No. 1045.

(23) Motorcycle Wheels and Rims

The present S.A.E. Recommended Practice for Motorcycle Wheels and Rims, specifies a steel composition for rims which is very nearly the same as and no more satisfactory than S.A.E. Steel No. 1010, hence present practice is revised to specify No. 1010.

	Present Specified Composition
% Carbon ...	0.10 to 0.15
% Manganese,	0.40 to 0.60
% Phosphorus, max.	0.05
% Sulphur, max.	0.05

S.A.E. Steel No. 1010
0.05 to 0.15
0.30 to 0.60
0.045
0.05

Marine Engine Specifications for 1921

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete lb.	Ignition
Acme 4-Cycle G.-K.						
H.D.	8	6¼x 7½	1	360	1470	M.&B.
H.D.	10	7¼x 9	1	340	1850	M.&B.
H.D.	16	6¼x 7½	2	366	2250	M.&B.
H.D.	20	7¼x 9	2	340	2925	M.&B.
H.D.	27	8¼x10	2	320	3975	M.&B.
H.D.	25	6¼x 7½	3	375	2550	M.&B.
H.D.	35	7¼x 9	3	350	4075	M.&B.
H.D.	45	8¼x10	3	325	5050	M.&B.
H.D.	55	8¾x10½	3	300	6680	M.&B.
H.D.	40	6¼x 7½	4	450	3475	M.&B.
H.D.	50	7¼x 9	4	375	5160	M.&B.
H.D.	65	8¼x10	4	350	6675	M.&B.
H.D.	85	8¾x10½	4	325	8200	M.&B.
H.D.	65	6¼x 7½	6	500	5825	M.&B.
H.D.	80	7¼x 9	6	425	6950	M.&B.
H.D.	100	8¼x10	6	400	8900	M.&B.
S.H.S.D.	125	8¾x10½	6	375	10800	M.&B.
S.H.S.D.	22	6¼x 7½	2	500	2150	J.S.
S.H.S.D.	35	6¼x 7½	3	500	2450	J.S.
S.H.S.D.	50	6¼x 7½	4	500	3350	J.S.
S.H.S.D.	75	6¼x 7½	6	500	4800	J.S.
Aerothrust 2-Cycle G.-K.						
1919	3	2½x 2¼	2	1000	85	J.S.
1919	5	3 x 3½	2	1000	115	J.S.
Amphion 2-Cycle G.						
Out-B.	3	2½x 2½	2	900	80	Mag.
In-B.	3	2½x 2½	2	900	80	Mag.
Anderson 4-Cycle G.-K.						
4	4	4½x 5	1	550	400	Bat.
8	8	4½x 5	2	550	550	Bat.
12	12	5 x 6	2	500	1000	Mag.
24	24	5 x 6	4	500	1600	Mag.
50	50	7 x 8½	4	450	2900	Mag.
Arrow 2-Cycle G.-K.						
K-1	2½-3	2¾x 3	1	700	36	B.or M.
K-2	5 -6	2¾x 3	2	750	60	B.or M.
A-4	4 -5	4 x 4	1	650	110	B.or M.
C-21	3	2¾x 3	1	1100	85	Mag.
C-21	3	2¾x 3	1	1100	80	Mag.
Automatic 4-Cycle G.-K.						
Open	3	4½x 5	1	500	300	M.&B.
Closed	6	4½x 5	2	500	525	M.&B.
....	9	4½x 5	3	500	760	M.&B.
....	6	5½x 7	1	400	643	M.&B.
....	12	5½x 7	2	400	1115	M.&B.
....	18	5½x 7	3	400	1425	M.&B.
....	24	5½x 7	4	400	1800	M.&B.
....	25	7½x 9	2	350	2625	M.&B.
....	37	7½x 9	3	350	3465	M.&B.
....	50	7½x 9	4	350	4430	M.&B.
....	75	10 x14	3	275	8000	M.&B.
....	100	10 x14	4	275	11780	M.&B.
En-	30	5 x 7	4	550	1850	J.S.
closed	45	5 x 7	6	550	2700	J.S.
....	40	5½x 7	4	550	1950	J.S.
....	60	5½x 7	6	550	2900	J.S.
....	50	6½x 8	4	500	3000	J.S.
....	75	6½x 8	6	500	4800	J.S.
....	70	7½x 9	4	500	4000	J.S.
....	105	7½x 9	6	500	6000	J.S.
....	100	8½x10	4	500	6000	J.S.
....	150	8½x10	6	500	9000	J.S.
American 2-Cycle G.-K.						
	2½	3¼x 3½	1	800	140	Bat.
....	4	3⅞x 3½	1	800	150	Bat.
....	6	4¾x 4½	1	800	200	Bat.
....	8	5¼x 5	1	600	335	Bat.
....	8	3⅞x 3½	2	1000	220	Bat.
....	8	3⅞x 3½	2	800	280	Bat.
....	14	4¾x 4½	2	700	350	Bat.
....	20	5¼x 5	2	600	495	Bat.
....	30	4¾x 4½	4	850	595	Mag.
Capital 4-Cycle G.						
H-A4	32-34	4¼x 5½	4	1000	625	Delco.
H-A4	60-65	4¼x 5½	4	1500	625	Delco.
Barber 2-Cycle G.						
....	2½	3¼x 3¼	1	750	75	J.S.
....	5	3¼x 3¼	2	750	140	J.S.
....	8	3¼x 3¼	3	750	190	J.S.
....	4	4 x 4	1	600	150	J.S.
....	8	4 x 4	2	600	270	J.S.
....	12	4 x 4	3	600	390	J.S.
....	6	4¾x 4¾	1	600	245	J.S.
....	12	4¾x 4¾	2	600	375	J.S.
....	18	4¾x 4¾	3	600	500	J.S.
....	9	5½x 5¼	1	500	270	J.S.
....	18	5½x 5¼	2	500	535	J.S.
....	27	5½x 5¼	3	500	675	J.S.
....	12	6½x 6¼	1	500	400	J.S.
....	24	6½x 6¼	2	500	695	J.S.
....	36	6½x 6¼	3	500	925	J.S.
....	40	8 x 8	2	350	1950	J.S.
....	60	8 x 8	3	350	2850	J.S.
Barber 4-Cycle G.						
....	4	3½x 5	1	...	160	J.S.
V.	8	3½x 5	2	...	...	J.S.
B.O.E.C. 4-Cycle K.-Fuel Oil						
A-12¾	50	12¾x18	Single	250	17000	....
Barker 2-Cycle G.-K.						
A	1¼	3⅜x 3½	1	500	110	Opt.
B	2½	4⅛x 4¼	1	500	170	Opt.
C	4	2 x 4⅜	1	450	220	Opt.
D	6½	5⅛x 6½	1	400	350	Opt.
G	8	4⅜x 5	2	450	380	M.&B.
Bolinder 2-Cycle—Surface Ignition					tons	
....	500	20½x29½	4	160	55	....
....	320	16½x18⅞	4	225	28	....
....	240	14⅛x18⅞	4	250	21	....
....	160	16½x18⅞	2	225	14	....
....	120	14⅛x16⅛	2	250	11½	....
....	90	13 x13⅜	2	300	7	....
....	80	13 x13⅜	2	325	6½	....
....	65	11⅞x12¼	2	350	5½	....
....	50	10⅝x11	2	375	4½	....
....	40	9½x 9⅞	2	425	3	....
....	30	8½x 9	2	450	2½	....
....	40	13 x13⅜	1	325	5	....
....	32	11⅞x12¼	1	350	4	....
....	25	10⅝x11	1	375	3	....
Brennan 4-Cycle G.					lb.	
M	17-20	4 x 5	4	1000	650	B.&M.
B	25-35	4½x5	4	800	750	B.&M.
"B" spec	35-40	4½x 5	4	1200	700	B.&M.
6B	40-50	4½x 5	6	1200	850	B.&M.
6B Mex.	40	4½x 5	6	750	950	B.&M.
11	30-40	5 x 5	4	1000	850	B.&M.
12	35-50	5½x 6	4	800	1100	B.&M.
12	40-80	6 x 6	4	800	1250	B.&M.
6D	75-100	4½x 6½	6	1000	800	B.&M.
Bridgeport 2-Cycle G.-K.						
40	4½	4½x 5	1	500	225	Opt.
50	6	5¼x 5¼	1	500	260	Opt.
80	9	5½x 5	2	500	375	Opt.
100	12	5¼x 5¼	2	500	470	Opt.
243	30	6½x 7	3	400	1800	Bosch
363	45	7½x 9	3	375	3200	Bosch
484	60	7½x 9	4	375	4000	Bosch
142	14	5½x 6½	2	500	850	Bat.
Buffalo 4-Cycle G.-K.						
....	3-4	3 x 4	2	700	240	.....
....	5-6	3½x 5	2	600	400	.....
....	16-20	3¾x 5	4	800	710	.....
....	25-30	3¾x 5	4	800	800	.....
....	40-60	5½x 7	4	700	1730	.....
....	50-80	6¾x 9	4	700	2600	.....
....	10-12	5 x 6½	2	400	1170	.....
....	13-15	6 x 7½	2	350	1400	.....
....	20-22	7 x 9	2	350	2100	.....
....	20-24	5 x 6½	4	400	1960	.....
....	26-30	6 x 7½	4	350	2525	.....
....	40-45	7 x 9	4	350	3655	.....
....	60-70	7 x 9	6	350	4850	.....
....	88-100	10 x12	4	300	8200	.....
....	125-150	10 x12	6	300	12800	.....
H. L. B. 2-Cycle G.						
E.	2-3	3¼x 3	1	900	42	U.S.
N. L. B. 4-Cycle						
G.	4	2½x 5	2	900	125	U.S.
Diesel 4-Cycle D.						
B.	120	10½x13	4	300	47000	.....
B.	165	11¾x15	4	276	61000	.....
B.	250	13¾x17½	4	257	92000	.....
B.	365	16½x21	4	225	135000	.....
B.	520	19 x24½	4	200	185000	.....
Diesel 2-Cycle						
C.M.	650	17 x27	4	165	....	.....
C.M.	1100	22 x34	4	135	.....	.....
C.M.	1800	28 x44	4	105	.....	.....
C.M.T.	1100	17 x27	6	165	.....	.....
C.M.T.	1850	22 x34	6	135	.....	.....
C.M.T.	3000	28 x44	6	105	.....	.....
Cady 2-Cycle G.						
....	1½	3 x 2½	1	700	45	J.S.
....	3	3⅝x 3¾	1	700	90	J.S.
....	6	3⅝x 3¾	2	700	135	J.S.
....	4	4½x 4	1	700	140	J.S.
....	8	4½x 4	2	700	205	J.S.
Cady 4-Cycle G.						
....	12-16	3¾x 4	4	1000	300	J.S.
Perfection 2-Cycle G.						
....	2½	3¼x 3½	1	2-200	140	Bat.
....	3½-4	3⅞x 3½	1	2-800	150	Bat.
....	6	4¾x 4½	1	2-800	200	Bat.
....	8	5¼x 5	1	1-5	335	Bat.
....	7-8	3⅞x 3½	2	2-800	220	Bat.
....	14	4¾x 4½	2	2-700	350	Bat.
....	18-20	5¼x 5	2	1-600	495	Bat.
....	30	4¾x 4½	4	1-1000	600	Bat.
....	2	2⅝x 2½	1	700	65	Bat.
....	2	2⅝x 2½	1	800	50	Mag.
Perfection 4-Cycle G.						
....	14	3½x 4	4	1-950	650	Mag.
....	2	2⅝x 2½	1	700	75	Mag.
Knox 2-Cycle G.-K.						
E.	3	4 x 4	1	600	205	M. or B.
E.	4½	4¼x 4½	1	550	250	Bat.
E.	5½	5 x 5¼	1	550	330	Bat.
E.	7½	5½x 6¼	1	500	500	Bat.
E.	6	4 x 4	2	600	340	Bat.
E.	9	4¼x 4½	2	550	380	Bat.
E.	11	5 x 5¼	2	550	480	Bat.
E.	15	5½x 6¼	2	500	760	J.S.
Knox 4-Cycle G.-K.						
F.	25	7 x 8	2	500	1900	M.&B.
F.	50	7 x 8	4	500	3300	M.&B.
F.	75	7 x 8	6	500	4500	M.&B.
G.	6	5 x 5¼	1	600	575	M.&B.
G.	8	5½x 6¼	1	600	700	M.&B.
G.	12	5 x 5¼	2	600	950	M.&B.
G.	16	5½x 6¼	2	600	1100	M.&B.
Chesapeake 4-Cycle G.						
L.	7	5 x 6	1	475	350	Mag.
L.	14	5 x 6	2	475	575	Mag.
....	20	4 x 5	4	575	550	Mag.
Chesapeake 2-Cycle G.						
B.	5	5 x 5	1	500	270	Bat.
B.B.	10	5 x 5	2	500	475	Bat.
Honest-Clay 4-Cycle G.-K.						
....	4	4½x 5	1	500	385	Bat.
....	8	4½x 5	2	500	575	Bat.
R.	6	5½x 7	1	375	675	Bat.
R.	8	6½x 7	1	375	825	Bat.
R.	10	7½x 7	1	375	950	Bat.
R.	12	5½x 7	2	375	1300	Bat.
R.	16	6½x 7	2	375	1525	Bat.
R.	20	7½x 7	2	375	1750	Bat.
R.	25	5½x 7	4	450	2300	Mag.
R.	35	6½x 7	4	450	2600	Mag.
R.	50	7½x 7	4	450	3000	Mag.
O.	25-28	7½x 9	2	375	2650	Bat.
O.	30-35	8½x 9	2	375	2800	Bat.
O.	38-42	8½x10¼	2	375	3000	Bat.
T.	40-50	8½x10	2	375	4000	Mag.
T.	80-100	8½x10	4	375	7000	Mag.
Clift 4-Cycle G.						
....	4	3¾x 4½	1	750	250	J.S.
....	8	3¾x 4½	2	750	350	J.S.
....	7	5 x 6	1	650	600	J.S.
....	15	5¾x 7	2	600	1200	M.&B.
....	20	4 x 5¾	2	600	1450	M.&B.
....	100	11 x13	4	600	20000	.....
Quale 4-Cycle HVID.						
4-M-28	30	4¾x 6½	4	650	2150	.....
4-S-30	30	4¾x 6½	4	600	1650	.....

ABBREVIATIONS: H-D—Heavy Duty; †—Semi-High Speed, Heavy Duty; ‡—Outboard; **Mag**—Magneto; **J. S.**—Jump-Spark; **Be & Bo**—Berling or Bosch; **Eismn**—Eisemann; **B or M**—Battery or Magneto; **G**—Gasoline; **K**—Kerosene; **D**—Distillate; **S-D**—Semi-Diesel; **At-K**—Atwater-Kent.

In revolutions per minute column when there is more than one figure given—as for instance 7-900—it indicates that the R.P.M. range is 700 to 900. In each case the first number represents hundreds.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
Curtiss 4-Cycle G.						
O.X.-5	90	4 x 5	8	1400	390	.....
O.X.X.-6	100	4½x 5	8	1400	412	.....
K-6	150	4½x 6	6	1700	417	.....
K-12	400	4½x 6	12	2500	680	.....
Speedway 4-Cycle G.						
K.	22-28	4 x 4½	4	1-1200	560	Be.&Bo.
Z.	35-44	4½x 5½	4	1-1200	950	Be.&Bo.
Z.	50-66	4½x 5½	6	1-1200	1200	Be.&Bo.
M.	130-150	5¾x 7	6	1-1200	1900	Be.&Bo.
M.	175-200	5¾x 7	8	1-1200	2350	Be.&Bo.
M.	48-75	5¾x 7	4	6-1000	1850	Be.&Bo.
M.	75-130	5¾x 7	6	6-1000	2400	Be.&Bo.
M.	100-175	5¾x 7	8	6-1000	2900	Be.&Bo.
L.	30-115	6¾x 8½	6	4-600	5000	Be.&Bo.
H.	200-250	11 x12	6	3-450	11400	Be.&Bo.
Dodge 4-Cycle HVID.						
....	12½	6¾x 9	1	425	3800	.....
....	25	6¾x 9	2	425	4800	.....
....	37½	6¾x 9	3	425	6200	.....
....	50	6¾x 9	4	425	7400	.....
....	75	6¾x 9	6	425	9700	.....
Doman 4-Cycle G.-K.						
K.	4	3¾x 4½	1	600-800	210	M.or B.
B.	5-7	4¾x 6	1	400-600	500	M.or B.
H.M.-2	12-15	4¾x 6	2	600-800	750	Mag.
H.M.-4	25-40	4¾x 6	4	600-900	1200	Mag.
T.-2	20-25	6 x 7	2	400-800	1200	Mag.
T.-4	40-50	6 x 7	4	400-800	1950	Mag.
Dow 4-Cycle Crude or Fuel Oil						
A.	320	12 x18	6	250	125000	.....
A.	425	12 x18	8	250	160000	.....
B.	500	15 x22¼	6	220	185000	.....
B.	666	15 x22¼	8	220	215000	.....
C.	500	16 x26	6	175	194000	.....
C.	666	16 x26	8	175	233000	.....
F.	900	21¼x28⅜	6	140	325000	.....
H.	1500	24⅛x37⅛	6	125	534000	.....
Dupont 4-Cycle G.-K.						
D.T.	20	5 x 6½	2	750	1100	Eismn.
D.F.	40	5 x 6½	4	750	1600	Eismn.
D.S.	60	5 x 6½	6	750	2150	Eismn.
Erd 4-Cycle G.-K.						
T.	30	4 x 6	4	900	170	Mag.
A.	42	4¾x 6	4	900	1100	Mag.
Evansville 4-Cycle G.						
Reg.	3¾	4½x 5	1	500	300	Bat.
Reg.	7½	4½x 5	2	500	400	Bat.
Reg.	15	4½x 5	4	500	625	Mag.
Reg.	5	5 x 6	1	500	400	Bat.
Reg.	10	5 x 6	2	500	540	Bat.
Reg.	20	5 x 6	4	500	900	Mag.
Reg.	8	6 x 6¼	1	500	625	Bat.
Reg.	16	6 x 6¼	2	500	900	Bat.
Reg.	24	6 x 6¼	3	500	1200	Bat.
Reg.	32	6 x 6¼	4	500	1425	Mag.
Reg.	11	7 x 9	1	350	1150	Bat.
Reg.	22	7 x 9	2	350	1800	Bat.
Reg.	44	7 x 9	4	350	2900	Mag.
Evinrude 2-Cycle G.						
....	2	2⅝x 2½	1	800	73	Mag.
....	3½	2½x 3	1	650	116	.....
C.C.	2	2 x 2⅝	1	800	45	.....
Fay and Bowen 4-Cycle G.						
L-40	17	3¼x 4½	4	1400	450	Mag.
L-41	22	3½x 5	4	1200	525	Mag.
L-41	20	3½x 5	4	600	450	Mag.
LN-42	40	4¼x 5½	4	1400	900	Mag.
LN-42	25	4½x 5½	4	600	700	Mag.
L-43	40	4¾x 5½	4	1000	950	Mag.
L-43	30	4¾x 5½	4	600	700	Mag.
L-44	45	5 x 6¼	4	1000	1095	Mag.
L-44	30	5 x 6¼	4	600	800	Mag.
L-63	50	4½x 5½	6	1000	1275	Mag.
L-63	47	4½x 5½	6	600	900	Mag.
L-64	45-75	5 x 6¼	6	6-1100	14800	Mag.
L-64	45-75	5 x 6¼	6	6-1100	1200	Mag.
C.O. 2-Cycle Semi-Diesel						
C.O.	30	.....	2	400	5050	.....
C.O.	45	.....	3	400	6870	.....
C.O.	60	.....	4	400	8000	.....
C.O.	75	.....	3	340	14800	.....
C.O.	100	.....	4	340	17600	.....
C.O.	150	.....	3	250	34000	.....
C.O.	200	.....	4	250	41000	.....
C.O.	300	.....	6	250	57400	.....
Franzer-Adams 2-Cycle G.						
....	2	3 1/16x 3	1	2-1000	70	J.S.
....	4	3 1/16x 3	2	2-1000	130	J.S.
....	5	3¾x 4¼	1	2-1000	140	J.S.
....	10	3¾x 4¼	2	2-1000	220	J.S.
Frisbie 4-Cycle G.-K.						
A.	5	4¾x 5	1	550	325	.....
C.	7	6 x 6	1	450	500	.....
B.	10	4¾x 5	2	550	430	.....
D.	16	6 x 6	2	475	700	.....
R.	18	4¾x 5	3	650	650	.....
N.	25	6 x 6	3	600	1050	.....
E.	30	6¾x 5	4	800	725	.....
F.	40	6 x 6	4	600	1200	.....
K.	50	6¾x 5	6	850	985	.....
L.	75	6 x 6	6	800	1600	.....
Gaeth 4-Cycle G.-K.						
....	14-18	5½x 8	2	4-600	1450	M.&B.
....	20-27	5½x 8	3	4-600	1800	M.&B.
....	28-36	5½x 8	4	4-600	2100	M.&B.
....	42-54	5½x 8	6	4-600	3000	M.&B.
....	36-50	5½x 8	4	4-600	2100	M.&B.
....	54-75	5½x 8	6	4-600	3000	M.&B.
Gaffga 2-Cycle G.						
A.	3	4 x 4	1	550	225	M.&B.
....	4	4⅝x 5	1	500	325	M.&B.
....	5	5 x 5½	1	475	350	M.&B.
....	6	5½x 6	1	450	425	M.&B.
....	8	6 x 6½	1	400	475	M.&B.
....	6	4 x 4	2	550	375	M.&B.
....	8	4⅝x 5	2	500	425	M.&B.
....	10	5 x 5½	2	475	525	M.&B.
....	12	5½x 6	2	450	700	M.&B.
....	16	6 x 6½	2	400	850	M.&B.
Gaffga 4-Cycle G.						
....	12	5 x 6	2	600	900	Bosch
Gierholtt 2-Cycle G.						
....	2	2¾x 2½	1	800	50	Bat.
....	2	2¾x 2½	1	800	56	Mag.
Monarch 4-Cycle G.-K.						
....	5-45	5 x 6	1-6	550	.....	J.S.
....	7-60	6 x 7	1-6	550	.....	or
....	72	8 x 9	4	400	.....	M.&B.
....	40-168	10 x10	2-6	400	.....	.....
Gray 2-Cycle G.-K.						
U.	3	3½x 3½	1	3-1300	90	J.S.
U.	5½	4½x 4½	1	7-1100	170	J.S.
U.	6	3½x 3½	2	7-1100	138	J.S.
Gray 4-Cycle G.-K						
X-V.	20-25	3½x 3½	4	5-1200	650	Mag.
E.	25-35	4 x 6	4	5-1000	800	Mag.
E.	35-45	4¾x 6	4	5-1000	1100	Mag.
Hartford 2-Cycle-G.						
X.	3-5	4 x 4½	1	5-700	330	M.&B.
X.	6-8	4½x 4½	1	5-700	335	M.&B.
X.	7-10	5 x 5¼	1	5-700	440	M.&B.
X.	14-20	5 x 5¼	2	5-700	620	M.&B.
Gray Prior 4-Cycle K. & G.						
D-4	3-6	4½x 8	4	6-750	1950	J.S.
Hall-Scott 4-Cycle G.						
LM-4	125	5 x 7	4	1700	1100	Delco.
LM-4	200	5 x 7	6	1700	1300	Delco.
Hess 4-Cycle Gasoline						
A-3	5	3¾x 4	1	925	225	Bosch
Hettinger 4-Cycle G.						
6	6	5½x 6	1	460	400	M.&B.
9	9	4½x 6	2	450	590	At-K.
12	12	5½x 6	2	450	650	M.&B.
18	18	6½x 8	2	400	1500	At-K.
25	25	7½x 9	2	350	2000	At-K.
36	36	6½x 8	4	400	3000	At-K.
50	50	7½x 9	4	350	4500	At-K.
Jacobson 2-Cycle Heavy Oil						
....	20	8½x10	1	410	2500	.....
....	25	9½x10	1	410	2700	.....
....	30	10½x11	1	375	3400	.....
....	35	11 x13	1	340	4500	.....
....	40	12 x13	1	340	5000	....
....	40	8½x10	2	410	4750	....
....	50	9½x10	2	410	5100	....
....	60	10½x11	2	375	5650	.....
....	70	11 x13	2	340	8200	.....
....	80	12 x13	2	340	8800	.....
....	60	8½x10	3	410	6300	.....
....	75	9½x10	3	410	6700	.....
....	90	10½x11	3	375	7500	.....
....	105	11 x13	3	340	9700	.....
....	120	12 x13	3	340	10300	.....
....	80	8½x10	4	410	7400	.....
....	100	9½x10	4	410	7800	.....
....	120	10½x11	4	375	9200	.....
....	140	11 x13	4	340	11500	.....
....	160	12 x13	4	340	12600	.....
Bud-E 2-Cycle G.						
Bud-E.	5	3 x 3	2	1200	126	Mag.
J. V. D. 4-Cycle G.-K.						
A-4	28-40	4¾x 6	4	600- 900	1450	Mag.
A4-R.	45-60	4¾x 6	4	1000-1450	1350	Mag.
A-4	28-40	4¾x 6	4	600- 900	1450	Mag.
A-4R.	45-60	4¾x 6	4	1000-1450	1350	Mag.
Kahlenberg 2-Cycle G.-K.						
1920	2-3	3½x 3½	1	600	125	M.&B.
1920	3-4	4 x 4	1	550	160	M.&B.
1920	4-6	5 x 5	1	400	400	M.&B.
1920	6-8	5½x 6	1	400	550	M.&B.
1920	9-12	6½x 7	1	350	750	M.&B.
1920	12-15	7 x 8	1	325	900	M.&B.
1920	6-8	4 x 4	2	550	350	M.&B.
1920	8-12	5 x 5	2	400	650	M.&B.
1920	12-16	5½x 6	2	380	950	M.&B.
1920	18-24	6½x 7	2	350	1300	M.&B.
1920	24-36	7 x 8	2	325	1800	M.&B.
1920	30-36	7¾x 8	2	325	2000	M.&B.
1920	50-55	9 x10	2	300	3400	M.&B.
1920	27-36	6½x 7	3	325	1700	M.&B.
1920	36-45	7 x 8	3	325	2600	M.&B.
1920	45-54	7¾x 8	3	325	2800	M.&B.
1920	75-85	9 x10	3	300	5000	M.&B.
1920	50-60	.....	2	340	8500	.....
1920	75-90	.....	3	340	10000	.....
1920	100-120	.....	4	340	15000	.....
Airdrive 4-Cycle G.†						
L-2	3	2 x 2½	2	2100	67	Mag.
M-2	10	4 x 3⅞	2	1400	122	Mag.
O-4	24	3¾x 4½	4	1100	575	Mag.
O-4	15-35	.....	..	.....	....	.....
Kermath 4-Cycle G.-K.						
12	12	3½x 4	4	6-1200	470	Bosch
16	16	3¾x 4	4	6-1200	500	Bosch
20	20-25	4 x 4	4	6-1200	535	Bosch
40	24-40	4½x 6¼	4	5-1200	1350	Bosch
Knox 4-Cycle G.-K.						
350	40	5 x 5½	4	800	1100	M.&B.
940	20	3½x 5	4	1000	.....	.....
Koban 2-Cycle G.†						
H.	3	2⅝x 2⅜	2	8-900	80	M.&B.
Fisherman 4-Cycle G.						
G-6	6	5 x 6	1	550	550	J.S.
G-12	12	5 x 6	2	550	850	J.S.
K-6	6	5 x 6	1	550	550	J.S.
K-12	12	5 x 6	2	550	850	J.S.
G-3½	3½	3¾x 5	1	650	250	J.S.
Fisherman 4-Cycle						
G-3½	3½	3½x 3½	1	750	210	J.S.
Lockwood-Ash 2-Cycle G.						
†	2	2⅝x 2	1	700	70	J.S.
24	2½	3¼x 3½	1	750	.....	J.S.
24	4	4 x 4	1	750	.....	J.S.
68	6	3½x 3½	2	800	.....	J.S.
68	8	4 x 4	2	800	.....	J.S.
Lockwood-Ash 4-Cycle G						
44	14	3¾x 4½	4	800	600	Mag.
Lathrop 2-Cycle G.-K.						
1920	3	4 x 4	1	500	.....	M.&B.
1920	4	4½x 5	1	500	.....	M.&B.
1920	5	5 1/16x 5	1	500	.....	M.&B.
1920	6 Lt.	5½x 5	1	500	.....	M.&B.
1920	6 St.	5¼x 6½	1	400	.....	M.&B.
1920	7	6 x 6½	1	375	.....	M.&B.
1920	8	6½x 6½	1	375	.....	M.&B.
1920	10	7 x 7½	1	300	.....	M.&B.
1920	12	7½x 7½	1	275	.....	M.&B.
1920	8	4½x 5	2	550	.....	M.&B.
1920	10	5 1/16x 5	2	500	.....	M.&B.
1920	12 Lt.	5½x 5	2	500	.....	M.&B.
1920	12 St.	5¼x 6½	2	400	.....	M.&B.
1920	14	6 x 6½	2	400	.....	M.&B.
1920	16	6½x 6½	2	400	.....	M.&B.
1920	20	7 x 7½	2	300	.....	M.&B.
1920	24	7½x 7½	2	275	.....	M.&B.
1920	36	7½x 7½	3	275	.....	J.S.
1920	12	5 1/16x 6½	2	500	.....	J.S.
1920	16	5½x 6½	2	500	.....	J.S.
1920	21	5 1/16x 6½	3	500	.....	J.S.

ABBREVIATIONS: H-D—Heavy Duty; †—Semi-High Speed, Heavy Duty; ‡—Outboard; **Mag**—Magneto; **J-S**—Jump-Spark; **Be & Bo**—Berling or Bosch; **Eismn**—Eisemann; **B or M**—Battery or Magneto; **G**—Gasoline; **K**—Kerosene; **D**—Distillate; **S-D**—Semi-Diesel; **At-K**—Atwater-Kent.

In revolutions per minute column when there is more than one figure given—as for instance 7-900—it indicates that the R.P.M. range is 700 to 900. In each case the first number represents hundreds.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
1920	30	5½x 6½	3	700	.....	J.S.
1920	28	5 1/16x 6½	4	500	.....	J.S.
1920	40	5½x 6½	4	700	.....	J.S.
Mecco 4-Cycle G.						
A.	4	4½x 5	1	600	220	Mag.
B.	5	5 x 6	1	500	375	Mag.
AA.	9	4½x 5	2	600	375	Mag.
4-A	16	4½x 5	4	600	500	Mag.
C-2	12	5½x 6½	2	500	550	Mag.
C-3	18	5½x 6½	3	500	775	Mag.
M'Intosh & Seymour Corp. 4-Cycle Diesel						
M6B25	390	.....	6	265	.....	.....
M6B33	640	.....	6	190	.....	.....
M6C44	1200	.....	6	140	.....	.....
M6C50	1550	.....	6	115	.....	.....
M6C56	2000	.....	6	105	.....	.....
M8C56	2700	.....	8	105	.....	.....
Mianus 2-Cycle G.-K.						
A.	3	4 x 4	1	550	175	M.&B.
A.	5	4 5/16x 5	1	500	280	M.&B.
M.	6	4 5/16x 5	1	700	270	J.S.
A.	7½	5 3/16x 6	1	450	415	M.&B.
A.	10	6½x 7	1	375	675	M.&B.
A-2	6	4 x 4	2	550	300	M.&B.
A-2	10	4 5/16x 5	2	500	500	M.&B.
M-2	12	4 5/16x 5	2	700	500	J.S.
A-2	15	5 3/16x 6	2	450	750	M.&B.
A-2	20	6½x 7	2	375	1170	M.&B.
XI.	30	6½x 7	3	375	2000	J.S.
F-2	16	6 x 8	2	400	1600	M.&B.
F-3	24	6 x 8	3	400	2200	.....
F-4	32	6 x 8	4	400	2750	.....
A.	7½	5 3/16x 6 5/8	1	500	1000	.....
B.	15	5 3/16x 6 5/8	2	500	1700	.....
C.	15	7 1/16x 9 7/8	1	360	3100	.....
D.	30	7 1/16x 9 7/8	2	360	5100	.....
E.	45	7 1/16x 9 7/8	3	360	6500	.....
F.	60	7 1/16x 9 7/8	4	360	8200	.....
Mietz 2-Cycle Semi-Diesel						
....	15	6 x 6½	2	500	1995	.....
....	22	6 x 6½	3	500	2520	.....
....	40	9 x10	2	400	6300	.....
....	50	10 x12	2	340	11000	.....
....	60	9 x10	3	400	7500	.....
....	75	10 x12	3	340	14000	.....
....	100	10 x12	4	340	18000	.....
....	150	14 x18½	3	240	35000	.....
....	200	14 x18½	4	240	42000	.....
....	350	16 x21	4	240	65000	.....
Miller 4-Cycle G.-K.						
F-1	4	4½x 5	1	600	400	Mag.
1-1	6	5¼x 6	1	500	500	Mag.
F-2	10	4½x 6	2	600	600	.....
1-2	14	5¼x 6½	2	500	800	.....
E-4	12-20	3½x 5	4	6-900	650	Mag.
F-4	18-22	4½x 6	4	5-800	1200	.....
1-4	24-30	5¼x 6	4	5-700	1500	.....
R-4	28-35	5¼x 7½	4	4-550	1900	.....
S-4	40-50	6 x 9	4	350-450	2700	.....
Miller 2-Cycle						
P-1	2½	2¾x 2½	1	850	70	.....
M. & T. 4-Cycle G.-1						
E-2	18	6½x 8	2	425	1600	M.&B.
E-3	28	6½x 8	3	450	1900	M.&B.
E-4	40	6½x 8	4	450	2500	Opt.
E-6	60	6½x 8	6	500	3000	Opt.
E-4	60	7½x10	4	375	4000	Opt.
J-6	400	7¼x 9	6	1400	3350	Mag.
K-6	300	6¼x 7¾	6	1600	2100	Mag.
Missouri 4-Cycle G.						
....	8	4 3/16x 5	2	500	....	J.
....	12	5 x 6	2	500	....	J.
....	18	4 3/16x 5	4	500	....	J.
....	24	5 x 6	4	500	....	J.
Missouri 2-Cycle Semi-Diesel						
....	7	5 x 6	1	500	....	.....
....	14	5 x 6	2	500	....	.....
....	22	5 x 6	3	500	....	.....
....	30	5 x 6	4	500	....	.....
N. & S. 4-Cycle G.						
....	4	3¾x 5	1	800	350	M.&B.
....	20	7 x 9	2	350	3200	M.&B.
....	20	7 x 9	2	350	2800	M.&B.

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In revolutions per minute column when there is more than one figure given—as for instance 7-900—it indicates that the R.P.M. range is 700 to 900. In each case the first number represents hundreds.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	30	8 x10	2	325	3500	M.&B.
....	40	8 x 9	3	325	4600	M.&B.
....	80	10½x12	3	320	8000	M.&B.
Ford Marine 4-Cycle G.						
....	10-15	3¾x 4	4	800-1200	450	At-K.
Nlseco-Diesel						
....	120	9 x12½	4	350	17400	.....
....	180	9 x12½	6	350	22820	.....
....	240	9 x12½	8	350	28375	.....
....	240	13 x18	4	240	34400	.....
....	360	13 x18	6	240	56940	.....
....	480	13 x18	8	240	76000	.....
....	600	16½x24	6	225	120000	.....
20th Century 4-Cycle G.-K.						
1919	15-20	6½x 8½	2	400	2000	Mag.
1919	40-50	6½x 8½	4	400	3400	Mag.
1919	65-75	6½x 8½	6	400	4500	Mag.
Niagara 4-Cycle G.						
E-2	12	4¾x 5½	2	900	625	M.&B.
E-4	30	4¾x 5½	4	1000	925	M.&B.
D-4	50	6¼x 7	4	1000	1650	M.&B.
D-6	60	6¼x 7	6	1000	2350	M.&B.
D-8	80	6¼x 7	8	1000	3250	M.&B.
Ontario 2-Cycle G.						
....	2	2 5/16x 3	1	1650	70	Mag.
....	3	3½x 3½	1	900	125	Mag.
....	6	3½x 3½	2	900	190	Mag.
....	9	3½x 3½	3	900	270	Bat.
....	12	3½x 3½	4	900	350	Bat.
....	7	5 x 5	1	450	300	Bat.
....	14	5 x 5	2	600	500	Bat.
....	21	5 x 5	3	600	700	Bat.
....	28	5 x 5	4	600	900	Bat.
Palmer 4-Cycle G.						
NL-1	3½	4½x 4½	1	4-600	350	J.S.
NL-2	7	4½x 4½	2	4-600	350	J.S.
RW-1	6	5 3/16x 6	1	4-600	425	J.S.
RA-1	4½	4½x 6	1	4-600	375	J.S.
RA-2	10	4½x 6	2	4-600	650	At-K.
RA-3	14	4½x 6	3	4-600	900	At-K.
RA-4	19	4½x 6	4	4-600	1150	At-K.
NR-1	5	5 x 6	1	4-600	400	J.S.
NR-2	11	5 x 6	2	4-600	750	At-K.
NR-3	16	5 x 6	3	4-600	1000	At-K.
NR-4	22	5 x 6	4	4-600	1250	At-K.
F-2	17	6 3/16x 8	2	350-400	1600	At-K.
F-3	25	6 3/16x 8	3	350-400	2000	At-K.
F-4	32	6 3/16x 8	4	350-400	2400	At-K.
F-6	50	6 3/16x 8	6	350-400	3800	At-K.
NK-2	20	7½x10	2	3-400	3000	At-K.
NK-3	30	7½x10	3	3-400	3500	At-K.
NK-4	45	7½x10	4	3-400	4200	At-K.
NK-6	75	7½x10	6	3-400	5600	At-K.
Palmer 2-Cycle						
C.	4	4½x 4½	1	450	240	M.&B.
D.	6	5 x 6	1	450	350	M.&B.
E.	7½	6 x 6	1	450	375	M.&B.
U-1	2	3¾x 3½	1	500	135	M.&B.
Q-1	2½	3¾x 3½	1	700	125	J.S.
Q-2	5	3¾x 3½	2	700	180	J.S.
P-1	4	4½x 4½	1	650	210	J.S.
P-2	8	4½x 4½	2	650	325	J.S.
Peerless 4-Cycle G.-K.						
....	5	5 x 6	1	650	450	Mag.
....	10	5 x 6	2	650	600	Mag.
....	16	4 x 6	4	750	750	Bat.
....	25	5 x 6	4	750	850	Bat.
....	20	5¾x 7	2	600	1200	Bat.
....	40	5¾x 7	4	600	1700	Bat.
Pierce-Budd 2-Cycle G.						
....	4	4 x 4	1	1000	125	At-K.
....	12	4 x 4	2	12-1600	170	At-K.
....	18	4 x 4	3	3-1800	240	At-K.
....	30	4 x 4	4	2-1800	300	Bosch
....	40	4 x 4	6	3-2000	395	Bosch
Remington 2-Cycle 4 H. P. Heavy Oil. 6 H. P. Semi-Diesel						
....	4-75	6 x 6	1-4	4-500	600-6000	....
....	6-75	5¾x 6	1-4	4-500	600-6000	....
Red Wing Thorobred G.-K.						
....	10	2¾x 4	4	1000	300	Bosch
A.	14	3½x 4½	4	800	670	Bosch
AA.	18	3¾x 4¾	4	800	680	Bosch
F.	28	4 1/16x 5	4	1000	610	Bosch
B.	32	4½x 5	4	1000	650	Bosch
Regal 4-Cycle G.-K.						
Y.	2	3¾x 3½	1	800	125	J.S.
FA.	4	4 x 4½	1	800	290	J.S.
UA.	5	4½x 5½	1	700	380	J.S.
EA.	7	5¼x 6½	1	600	760	J.S.
JA.	9	6½x 7½	1	500	1230	J.S.

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
FB.	8	4 x 4½	2	800	520	J.S.
UB.	10	4½x 5½	2	700	725	J.S.
EB.	14	5¼x 6½	2	600	985	J.S.
JB.	18	6½x 7½	2	500	1625	J.S.
UC.	20	4½x 5½	4	700	985	J.S.
EC.	30	5¼x 6½	4	600	1550	J.S.
JC.	36	6½x 7½	4	500	2700	J.S.
SC.	50	7½x 9	4	400	4600	J.S.
CB.	32	4½x 5½	4	1000	800	J.S.
Roberts 2-Cycle G.-K.						
T.	4	3½x 4	1	1000	98	Mag.
2-T	8	3½x 4	2	1000	140	Mag.
4-T	16	3½x 4	4	1000	210	Mag.
Roberts 4-Cycle G. or K.						
H.	8	3½x 4	2	1000	160	Mag.
Smith Marine Twin-Six 4-Cycle G.						
.....	400	5 x 7	12	1700	1075	Delco.
Mohawk 2-Cycle G.						
B-20	3½	3½x 3¾	1	900	145	Bosch
B-21	7	4½x 4½	1	900	225	Bosch
B-22	7	3½x 3¾	2	900	215	Bosch
B-23	14-16	4½x 4½	2	900	395	Bosch
S-24	5-6	4½x 3¾	1	1200	155	Bosch
S-25	10-12	4½x 3¾	2	1200	220	Bosch
S-26	15-21	4½x 3¾	3	1200	290	Bosch
S-27	21-30	4½x 4½	3	1200	495	Bosch
M-28	6	4½x 4½	1	700	275	Bosch
M-29	12	4½x 4½	2	700	400	Bosch
M-30	18	4½x 4½	3	700	510	Bosch
H-31	5	4½x 4½	1	500	310	Bosch
H-32	10	4½x 4½	2	500	510	Bosch
K-33	6	4½x 4½	1	700	280	Bosch
K-34	12	4½x 4½	2	700	410	Bosch
K-35	25	4½x 4½	4	700	775	Bosch
Scripps 4-Cycle G.-K.						
D-2	12-18	4½x 6	2	6-900	650	Bosch
D-4	25-35	4½x 6	4	6-900	1000	Bosch
D-4	40-50	4½x 6	4	1000	825	Bosch
D-6	35-45	4½x 6	6	6-900	1425	Bosch
D-6	60-75	4½x 6	6	1000	1100	Bosch
Motor-Go 2-Cycle G.						
....	2½	3¼x 3¼	1	750	97	Bat.
....	4	4 x 4	1	750	135	Bat.
....	6	3½x 3½	2	750	154	Bat.
....	8	4 x 4	2	750	222	Bat.
‡	1¼	2 5/16x 2½	1	850	70	Bat.
Werkspoor 2-Cycle Semi-Diesel						
....	9	*162x*164	1	500	1325	.....
....	16	210x240	1	400	2800	.....
....	24	236x280	1	375	3740	.....
....	38	224x256	2	375	5450	.....
....	55	260x290	2	375	7800	.....
....	70	280x260	2	325	9250	.....
....	120	360x400	2	300	17500	.....
....	140	280x360	4	325	16000	.....
....	185	420x480	2	250	25500	.....
....	240	360x400	4	300	32000	.....
....	360	420x480	4	250	46000	.....
....	500	420x480	6	225	70000	.....
....	550	420x750	6	165	160000	.....
....	850	520x900	6	135	240000	.....

*Bore and Stroke in Millimeters

Model	Rated H.P.	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
Frisco Standard 4-Cycle G.						
C.	5	5¾x 6½	1	400	1555	M.&B.
A.	8	4¾x 6	2	440	1800	M.&B.
B.	10	5½x 6	2	400	2190	.....
E.	12	6 x 7	2	380	2750	.....
F.	16	6¼x 7½	2	360	2930	.....
M.	20	7¼x 9	2	320	4635	.....
H.	25	6¼x 7	3	450	3710	.....
K.	30	6½x 8	3	360	5045	.....
O.	40	8 x10	3	320	6820	.....
P.	50	8¾x10½	3	300	9215	.....
O.	65	8 x10	4	360	7120	.....
R.	80	9¾x12	3	280	12710	.....
P.	85	8¾x10½	4	350	13150	.....
S.	110	11¾x15	3	250	20285	.....
R.	120	9¾x12	4	320	19500	.....
S.	175	11¾x15	4	275	28500	.....
S.	275	11¾x15	6	300	32700	.....
Smalley 2-Cycle G.						
MB.	4-6	4½x 4½	1	....	....	.....
MBB.	12-15	4½x 4½	2	....	....	.....
Standard 4-Cycle G.						
....	10-12	5 x 6½	2	400	850	Own
....	16-18	6 x 8	2	350	1200	Own
....	20-24	5 x 6½	4	400	1600	Own
....	24-27	6 x 8	3	350	1800	Own
....	32-37	6 x 8	4	350	2800	Own
....	50-54	6 x 8	6	350	3200	Own
....	50-60	6½x 8	4	550	3250	Mag.
....	65-75	8 x10	4	350	5300	Own
....	70-90	6½x 8	6	550	4200	Mag.
....	90-100	8 x10	6	350	8000	Own

Model	Rated H.P	Bore and Stroke	No. Cyls.	Normal R.P.M.	Weight Complete Lb.	Ignition
....	125-150	8½x11	6	350	5800	Own
....	220	10 x11	6	460	6300	Own
....	300	12 x14	6	350	9500	Own
....	500	12½x13	6	350	18000	Own
2-K.W.	4	4½x 4½	1	750	900	.....
4-K.W.	8	4½x 5½	2	700	1300	.....
Sterling 4-Cycle G.						
D.	12-15	5½x 7	2	4-500	1150	Mag.
E.	17-25	3¾x 5½	4	6-1000	600	Mag.
E.	17-25	3¾x 5½	4	6-1000	600	Mag.
E.	17-25	3¾x 5½	4	6-1000	600	Mag.
R.	225-250	5½x 6¾	8	15-1700	1495	Mag.
FH.	25-55	5½x 6¾	4	4-800	2050	Mag.
FH.	35-85	5½x 6¾	6	4-800	2450	Mag.
FH.	50-115	5½x 6¾	8	4-800	2750	Mag.
FM.	60-85	5½x 6¾	4	8-1200	1700	Mag.
FM.	85-125	5½x 6¾	6	8-1200	2250	Mag.
EM.	120-170	5½x 6¾	8	8-1200	2600	Mag.
FM.	240-300	6¾x 9	8	8-1200	5000-5600	Mag.
FS.	90-1000	5½x 6¾	4	12-1400	1400	Mag.
FS.	130-145	5½x 6¾	6	12-1400	1750	Mag.
FS.	180-200	5½x 6¾	8	12-1400	2400	Mag.
GR.	150	5¾x 6¾	4	15-1600	1525	Mag.
GR.	225	5¾x 6¾	6	1500	2000	Mag.
GR.	300	5¾x 6¾	8	1500	2800	Mag.
GM.	98	5¾x 6¾	4	6-1200	1875	Mag.
GH.	63	5¾x 6¾	4	4-800	2000	Mag.
GM.	145	5¾x 6¾	6	6-1200	2400	Mag.
GH.	94	5¾x 6¾	6	4-800	2500	Mag.
GM.	195	5¾x 6¾	8	6-1200	2900	Mag.
GH.	126	5¾x 6¾	8	4-800	3000	Mag.
Stork 2-Cycle G.						
....	3	3½x 3½	1	700	120	J.-S.
....	4	4 x 4	1	700	180	J.-S.
....	6	4½x 4½	1	700	225	J.-S.
....	8	5 x 5	1	700	370	J.-S.
....	6	3½x 3½	2	700	200	J.-S.
....	8	4 x 4	2	700	400	J.-S.
....	12	4½x 4½	2	700	450	J.-S.
....	16	5 x 5	2	700	555	J.-S.
....	12	4 x 4	3	700	550	J.-S.
....	18	4½x 4½	3	700	600	J.-S.
Stork 4-Cycle						
....	8	4½x 5½	2	600	700	.....
....	10	5 x 6	2	500	900	.....
....	12	5½x 6½	2	500	900	.....
....	16	6 x 7	2	400	1500	.....
....	20	6⅜x 8	2	400	2000	At-K.
....	25	7½x 9	2	400	2500	At-K.
....	16	4½x 5½	4	700	1200	At-K.
....	20	5 x 6	4	500	1500	Bosch
....	24	5½x 6½	4	500	1500	Bosch
....	32	6 x 7	4	400	5000	Bosch
....	40	6⅜x 8	4	400	3500	Bosch
....	50	7½x 9	4	400	4500	Bosch
....	30	4½x 5½	6	700	1400	Bosch
....	50	5½x 6½	6	700	1800	Bosch
....	75	7½x 9	6	400	6000	Bosch
Sturtevant 4-Cycle G.						
F-4	75	4½x 6	4	1600	700	Mag.
Summer 2-Cycle Heavy Oil						
F.	350	16½x22	4	200	40000	.....
S.	600	16½x22	6	200	40000	.....
Universal 4-Cycle G.-K.						
C.	9-12	2⅝x 4	4	1200	325	Mag.
Union 4-Cycle D.-G. or K.						
....	5	5¾x 6½	1	400	640	M.&B.
....	8	5¼x 6	2	500	1150	M. &B.
....	12	6 x 7	2	400	1290	M.&B.
....	16	6½x 8	2	400	1750	M.&B.
....	20	7½x 9	2	360	2900	M.&B.
....	35	7½x 9	3	360	4825	M.&B.
....	45	8¼x10½	3	360	6450	M.&B.
....	60	9 x11	3	320	7400	M.&B.
....	80	10 x12	3	310	10700	M.&B.
....	85	9 x11	4	330	10140	M.&B.
....	110	12 x15	3	280	17600	M.&B.
....	110	10 x12	4	330	12350	M.&B.
....	150	12 x15	4	290	22750	M.&B.
....	225	14½x18	4	225	36400	M.&B.
....	250	15¼x20	4	200	49785	M.&B.
....	300	16 x21	4	210	55700	M.&B.
....	125	9 x11	6	320	14400	M.&B.
....	225	12 x15	6	300	30600	M.&B.
....	325	14½x18	6	225	50400	M.&B.
....	375	15¼x20	6	200	68100	M.&B.
Van Blerck 4-Cycle G.						
M-4	75	5¾x 6	4	1000-1500	1798	Mag.
M-6	120	5¾x 6	6	1000-1500	2100	Mag.
M-8	150	5¾x 6	8	1000-1500	2667	Mag.
MM-4	40	5¾x 6	4	600-1000	1798	Mag.
MM-6	55	5¾x 6	6	600-1000	2100	Mag.
MM-8	75	5¾x 6	8	600-1000	2667	Mag.
Vulcan 4-Cycle G.						
....	4	4⅜x 6	1	550	300	J.-S.
....	5	5¼x 7	1	550	400	J.-S.
....	7½	6½x 7¼	1	450	600	J.-S.
....	11	7½x 8½	1	400	900	J.-S.
....	8	4⅝x 6	2	550	650	J.-S.
....	10	5¼x 7	2	500	900	J.-S.
....	15	6½x 7¼	2	475	1300	J.-S.
....	22	7½x 8½	2	425	2200	J.-S.
....	25	6½x 7¼	3	475	1700	J.-S.
....	35	7½x 8½	3	425	2800	J.-S.
....	56	8¾x10½	3	400	4200	J.-S.
....	16	4⅝x 6	4	550	900	J.-S.
....	20	5¼x 7	4	500	1200	J.-S.
....	30	6½x 7¼	4	475	2050	J.-S.
....	45	7½x 8½	4	425	3400	J.-S.
....	75	8¾x10½	4	375	5500	J.-S.
....	40	5¼x 7	6	550	1750	J.-S.
....	75	7½x 8½	6	425	4500	J.-S.
Venn-Severin 2-Cycle Semi-Diesel						
EM.	10	6 x 8	1	420	950	.....
FM.	15	8 x10	1	325	1875	.....
DM.	20	9½x11	1	325	2150	.....
IM.	40	12¼x13½	1	275	4950	.....
FMX.	30	8 x10	2	325	3380	.....
DMX.	40	9½x11	2	325	3950	.....
DMY	60	9½x11	3	325	4800	.....
IMX.	80	12¼x13½	2	275	9700	.....
IMY.	125	12¼x13½	3	275	14500	.....
IMZ.	170	12¼x13½	4	275	18700	.....
Goshen 2-Cycle G,						
A.	4	4 x 5	1	500	135	Bat.
C.	12	6 x 7	1	500	425	Bat.
E.	9	4 x 5	2	500	280	Bat.
G.	25	26 x 7	2	500	650	Bat.
Western 4-Cycle Diesel						
....	75	9¼x14	3	325	21000	.....
....	100	9¼x14	4	325	36000	.....
....	150	9¼x14	6	325	35000	.....
Winton 4-Cycle G.						
W-6	80	6½x 9	6	450	5400	Bosch
W-5	125	8 x11	6	400	10000	Bosch
W-11	200	9½x14	6	450	18000	Bosch
W-28	150	6½x 9	6	900	4000	Bosch
W-29	200	6½x 9	8	900	5000	Bosch
W-24	300	12¼x18	6	210	68000	Diesel
W-35	200	11 x14	6	250	44000	Diesel
W-40	400	12¼x18	8	210	84000	Diesel
52	50	7½x11	3	425	11500	Diesel
53	75	7½x11	4	425	15000	Diesel
54	125	7½x11	6	425	24000	Diesel
58	150	11 x14	4	260	30000	Diesel
Wisconsin 2-Cycle G.						
A.	5	4 x 4	1	700	160	Bat.
B.	7	4½x 4½	1	700	190	Bat.
C.	10	4 x 4	2	750	240	Bat.
D.	15	4½x 4½	2	750	300	Bat.
E.	20	4 x 4	3	850	340	Bat.
F.	27	4½x 4½	3	900	400	Bat.
J-L†	2	2⅝x 2½	1	750	55	Bat.
K-M‡	2	2⅝x 2½	1	750	55	Mag.
N‡	3½	3¼x 3¼	1	750	100	Mag.
Winona 2-Cycle G.						
....	5	4½x 4½	1	700	....	J.S.
....	10	4½x 4½	2	700	....	J.S.
....	15	4½x 4½	3	700	....	J.S.
....	20	4½x 4½	4	700	....	J.S.
Wisconsin (Consistent) 4-Cycle G.						
CM.	22	3¾x 5	4	1000	565	Mag.
EM.	24	4 x 5	4	1000	625	Mag.
AM.	40	4¾x 5½	4	1000	800	Mag.
JM.	48	5.1x5.5	4	1000	710	Mag.
MM.	62	5¾x 7	4	800	1290	Mag.
GM.	60	4¾x 5½	6	1000	1360	Mag.
PM.	90	5¾x 7	6	800	1565	Mag.
JRM.	110	5.1x5.5	4	2200	875	Mag.
LRM.	158	5.1x5.5	6	2200	1225	Mag.
Wolverine 4-Cycle K.-G.						
....	5	5½x 6	1	500	600	Simme
....	14	6½x 7	2	400	1545	Bosch
....	22	6½x 7	3	400	2285	Bosch
....	32	7½x 9	3	350	3914	Bosch
....	42	8½x 9	3	350	4130	Bosch
....	60	9½x12	3	360	7000	Bosch
....	80	11 x12	3	300	7516	Bosch
....	110	12½x14	3	300	12400	Bosch
....	160	11 x12	6	330	13600	Bosch
....	200	11 x15	6	330	17110	Bosch
....	35-40	5½x 7	4	700	1800	Bosch
Wright-Reliable 4-Cycle G.-K.						
S.	10	6 x 7½	1	450	1280	Bosch
S.	20	6 x 7½	2	450	1810	Bosch
S.	30	6 x 7½	3	450	2416	Bosch
S.	40	6 x 7½	4	450	3142	Bosch
S.	60	6 x 7½	6	450	4630	Bosch
P.	15	7½x 9	1	350	1780	Bosch
P.	30	7½x 9	2	350	3018	Bosch
P.	45	7½x 9	3	350	4068	Bosch
P.	60	7½x 9	4	350	5065	Bosch
P.	90	7½x 9	6	350	7000	Bosch

ABBREVIATIONS: H-D—Heavy Duty; †—Semi-High Speed, Heavy Duty; ‡—Outboard; **Mag**—Magneto; **J. S.**—Jump-Spark; **Be & Bo**—Berling or Bosch; **Eisnn**—Eisemann; **B or M**—Battery or Magneto; **G**—Gasoline; **K**—Kerosene; **D**—Distillate; **S-D**—Semi-Diesel; **At-K**—Atwater-Kent.

In revolutions per minute column when there is more than one figure given—as for instance 7-900—it indicates that the R.P.M. range is 700 to 900. In each case the first number represents hundreds.

Motor Boat Records

All World's Records for Respective Classes

Class	Distance	Average Speed M.P.H.	Best Lap	1 Mile Trials		Boat	Owner	Length	Powerplant
				Average of 6 Runs	Best Mile				
Hydroplane	30 Miles	70.00	71.4	76.65	77.69	Miss America	G. A. Wood	26	Two 440 H.P. Smithy-Liberty
Displacement Runabout (Marine Motors)	150 Miles	36.7	37.2	38.91	.....	Rainbow	H. B. Greening	32	One 220 H.P. Sterling
Displacement Runabout (Aviation Motors)	.....	....	....	49.25	.....	Miss Nassau	C. B. Johnston	28	One 450 H.P. Liberty
Express Cruiser (Marine Motor)	20 Miles	31.4	....	34.32	.....	Hoosier V	H. R. Duckwall	42	Two 200 H.P. Sterlings
Express Cruiser (Aviation type Motor)	20 Miles	34.45	....	36.6	.....	Gar Jr.	G. A. Wood	40	One 450 H.P. Liberty

British Marine Engine Practice

By M. W. Bourdon

THERE is a tendency on the part of British manufacturers of marine motors to specialize on a more limited range of models with differing bores and strokes than was the case before the war. Nevertheless, there are still several firms who do not specialize on any particular type or types but are prepared, it would appear, to vary the leading dimensions and details, to suit even purchasers of single engines.

The fact is, the output of the average British marine motor plant is so small that very little is done or attempted in the way of standardization. All makers, of course, have stock models, but most of them require but very little persuasion to induce them to vary these in accordance with purchasers' ideas or requirements.

It will be inferred from the foregoing that the British marine engine is often a "hand-made" proposition, and, as might be surmised, no endeavor is made to turn out a low-priced product. Most of the engines can be looked upon as fairly high-class jobs, which, while making no great pretense in the way of volumetric efficiency, are built and finished with reliability and durability foremost in consideration.

There are very few attempts to follow closely along lines adopted by car engine builders, and speeds above 1000 r.p.m. are the exception. No determined effort is apparent, except in isolated cases, to take advantage of the possibilities offered by adopting a higher rate of crankshaft revolution coupled with reducing gear between engine and propeller.

Thorneycroft has a model running normally at 1400 r.p.m. and intended to be used with a propeller turning at 350 r.p.m., and it is claimed for this that the increased propeller efficiency more than compensates for the transmission loss in the reduction gear.

Until a few years back the majority of British marine engines had T head cylinders, but these are now few and far between, the great majority having L heads. There are a few examples of overhead inlets with side exhausts, but both valves overhead appear only in the designs of two makers.

Only three firms supply two stroke engines, one of these being the makers of the original engine of the type, namely Day. This make has the largest two-stroke marine motor burning gasoline or kerosene on the British market, a two cylinder 4¾ x 5 in.

The majority of engines are designed for kerosene, but very little advance has occurred of late years in the method of vaporizing this fuel, the usual plan being to adopt a large heating chamber built up or cast with a portion of the exhaust manifold. Except in the smaller sizes it is becoming less frequent to find provision for starting on gasoline and switching over to kerosene, a more usual

Marine Engine Ex

	1914	1915	1916	1917	1918	July 1 to to Dec. 31, 1918	Calendar Year 1919	Totals for all years inc. 1912, 1913
EUROPE:	*137*	*25*	.....	.....	.....	.....	.....	*410*
Austria	$15,967	$3,097	.....	.....	.....	.....	.....	$47,375
	14	*10*	*7*	*2*	*2*	.....	*7*	*49*
Azores and Madeira Islands	$1,284	$1,291	$1,286	$1,240	$896	.....	$681	$8,317
	182	*10*	.....	.....	.....	.....	*30*	*501*
Belgium	$21,206	$1,472	.....	.....	.....	.....	$4,188	$66,327
	14	.....	.....	.....	.....	.....	.....	*34*
Bulgaria	$2,270	.....	.....	.....	.....	.....	.....	$5,783
	313	*71*	*153*	*270*	*90*	.....	*103*	*1,949*
Denmark	$31,273	$8,710	$15,686	$40,837	$12,768	.....	$28,393	$219,182
	411	*10*	*20*	*32*	.....	.....	*94*	*1,242*
Finland	$41,473	$3,824	$1,641	$21,299	.....	.....	$31,925	$187,403
	292	*81*	*69*	*800*	*155*	*61*	*138*	*1,925*
France	$22,332	$8,664	$6,620	$147,384	$170,560	$189,990	$120,699	$694,189
	618	*16*	.....	.....	.....	.....	.....	*1,823*
Germany	$70,964	$2,557	.....	.....	.....	.....	.....	$197,120
	2	*2*	*5*	*7*	.....	.....	*7*	*25*
Gibraltar	$253	$215	$817	$2,122	.....	.....	$1,531	$5,501
	12	*19*	*12*	*5*	.....	*1*	*107*	*177*
Greece	$1,533	$3,477	$5,220	$784	.....	$5,200	$117,530	$136,564
	.....	.....	.....	*8*	*10*	*12*	*3*	*33*
Iceland	.....	.....	.....	$593	$1,026	$839	$550	$3,008
	165	*74*	*85*	*266*	*358*	*132*	*174*	*1,455*
Italy	$23,749	$9,072	$83,978	$89,007	$464,498	$301,612	$369,841	$1,376,866
	2	*1*	.....	.....	.....	.....	*6*	*15*
Malta, Gozo, etc	$504	$52	.....	.....	.....	.....	$765	$2,089
	463	*231*	*377*	*333*	.....	.....	*298*	*2,306*
Netherlands	$45,556	$16,387	$34,288	$57,457	.....	.....	$70,316	$286,752
	490	*180*	*395*	*1,069*	*317*	*184*	*1008*	*4,515*
Norway	$57,368	$29,608	$55,859	$190,914	$58,128	$52,829	$180,021	$739,201
	21	*7*	*33*	*8*	*25*	*6*	*30*	*146*
Portugal	$1,791	$1,041	$4,466	$817	$15,032	$970	$29,712	$55,971
	20	*2*	*24*	.....	.....	.....	.....	*68*
Roumania	$3,324	$284	$1,822	.....	.....	.....	.....	$9,084
	363	*109*	*409*	*292*	*12*	.....	.....	*2,076*
Russia in Europe	$48,593	$19,876	$92,299	$108,434	$13,245	.....	.....	$4,027,702
	1	.....	.....	.....	.....	.....	.....	*1*
Serbia, Montenegro, etc	$54	.....	.....	.....	.....	.....	.....	$54
	77	*57*	*88*	*122*	*94*	*7*	*231*	*757*
Spain	$8,646	$7,100	$7,997	$27,916	$43,707	$17,847	$236,400	$358,494
	687	*66*	*177*	*190*	*49*	.....	*323*	*3,325*
Sweden	$64,526	$8,964	$40,573	$63,275	$10,715	.....	$86,162	$403,937
	22	*25*	*1*	.....	.....	.....	*51*	*122*
Switzerland	$3,478	$4,438	$260	.....	.....	.....	$11,738	$23,368
	18	*5*	.....	.....	.....	.....	*6*	*46*
Turkey in Europe	$3,337	$2,680	.....	.....	.....	.....	$1,001	$10,932
United Kingdom:	*958*	*622*	*1,241*	*783*	*341*	*6*	*1,326*	*6,543*
England	$72,952	$57,639	$223,539	$93,173	$174,988	$1,247	$217,658	$948,511
	134	*49*	*24*	*27*	.....	.....	*11*	*470*
Scotland	$16,343	$6,306	$3,256	$3,471	.....	.....	$3,213	$51,266
	44	*4*	*22*	*8*	.....	.....	*151*	*311*
Ireland	$2,801	$244	$848	$943	.....	.....	$18,083	$28,001
NORTH AMERICA:	*20*	*15*	*21*	*27*	*8*	*2*	*6*	*110*
Bermuda	$1,527	$1,667	$1,998	$5,609	$685	$467	$3,008	$16,405
	22	*25*	*11*	*35*	*14*	*12*	*16*	*143*
British Honduras	$4,833	$9,581	$1,980	$6,052	$2,272	$2,994	$4,888	$34,422
	1,747	*1,042*	*1,761*	*2,026*	*2,553*	*629*	*1,306*	*14,617*
Canada	$302,391	$147,730	$1,780,873	$757,735	$809,973	$272,391	$500,367	$5,262,436
CENTRAL AMERICA:	*14*	*13*	*5*	*7*	*1*	.....	*4*	*78*
Costa Rica	$4,811	$3,801	$978	$1,979	$231	.....	$432	$22,357
	5	*9*	*8*	*16*	*6*	.....	*14*	*59*
Guatemala	$408	$4,656	$648	$3,069	$449	.....	$4,925	$14,293
	10	*20*	*10*	*8*	*2*	*3*	*15*	*77*
Honduras	$1,339	$3,095	$986	$2,177	$1,206	$1,233	$4,953	$19,163
	21	*13*	*10*	*9*	*16*	*9*	*9*	*97*
Nicaragua	$3,963	$3,300	$3,007	$3,718	$9,237	$4,627	$8,198	$38,395
	27	*46*	*22*	*24*	*18*	*2*	*22*	*215*
Panama	$6,092	$12,080	$4,804	$5,257	$13,058	$250	$8,555	$62,294
	4	*9*	*2*	*6*	.....	.....	*2*	*29*
Salvador	$816	$1,248	$397	$536	.....	.....	$185	$3,855
	155	*45*	*64*	*94*	*79*	*60*	*193*	*1,067*
Mexico	$38,902	$13,193	$30,255	$35,458	$40,109	$49,450	$230,981	$554,603
	142	*9*	*30*	*33*	*70*	*36*	*123*	*524*
Miquelon, Langley, etc	$13,208	$814	$2,276	$2,922	$7,305	$5,033	$15,678	$56,162
	799	*953*	*769*	*577*	*735*	*461*	*1,414*	*6,240*
Newfoundland and Labrador	$103,895	$65,127	$81,911	$61,062	$80,811	$109,719	$193,327	$754,937
West Indies, British:	*1*	*1*	*13*	*4*	*3*	*1*	*2*	*27*
Barbados	$42	$97	$1,947	$1,753	$637	$886	$379	$6,191
	5	*5*	*2*	*9*	*5*	.....	*7*	*51*
Jamaica	$850	$600	$171	$1,449	$2,747	.....	$2,604	$11,098
	12	*8*	*11*	*11*	*20*	*3*	*11*	*90*
Trinidad and Tobago	$1,385	$1,012	$1,367	$1,028	$2,400	$899	$13,888	$25,156
	23	*20*	*12*	*8*	*7*	*2*	*25*	*106*
Other British	$5,506	$3,720	$2,058	$3,220	$1,227	$234	$14,279	$32,796
	217	*228*	*189*	*254*	*421*	*86*	*310*	*2,083*
Cuba	$30,393	$29,027	$26,344	$45,776	$75,143	$25,312	$102,656	$404,903
	4	*1*	*4*	*2*	*3*	.....	*1*	*24*
Dutch	$295	$128	$227	$243	$395	.....	$78	$2,031
	8	*13*	*30*	*10*	*11*	*1*	*14*	*87*
Dominican Republic	$1,908	$2,400	$4,830	$1,663	$4,008	$98	$5,766	$20,673
	6	*3*	*1*	*1*	*3*	*2*	*4*	*26*
Danish (Virgin Is. of U. S.)	$434	$273	$67	$75	$1,511	$1,162	$1,428	$6,088
	1	*1*	*5*	*6*	*15*	*2*	*10*	*60*
French	$124	$51	$1,028	$809	$1,528	$200	$3,938	$10,453
	5	.....	*2*	*14*	*11*	*1*	*5*	*40*
Haiti	$740	.....	$140	$1,116	$1,008	$120	$1,728	$5,336
SOUTH AMERICA:	*375*	*90*	*105*	*250*	*196*	*51*	*130*	*1,888*
Argentina	$70,058	$11,327	$14,101	$30,788	$30,004	$32,294	$106,194	$458,481
	1	.....	*5*	*3*	.....	.....	*11*	*24*
Bolivia	$34	.....	$573	$257	.....	.....	$8,708	$11,500
	301	*102*	*228*	*210*	*105*	*48*	*113*	*1,689*
Brazil	$62,882	$17,428	$25,862	$26,492	$19,259	$11,305	$69,749	$365,287
	58	*33*	*32*	*61*	*83*	*37*	*82*	*441*
Chile	$5,942	$3,821	$3,912	$13,288	$28,091	$33,308	$275,939	$371,514

ports, 1912 to 1919

	1914	1915	1916	1917	1918	July 1 to to Dec. 31, 1918	Calendar Year 1919	Totals for all years inc. 1912, 1913
	25	*38*	*24*	*53*	*5*	*5*	*21*	*201*
Colombia	$3,647	$4,218	$4,826	$4,818	$759	$2,444	$3,721	$36,523
	49	*56*	*14*	*38*	*11*	*3*	*11*	*267*
Ecuador	$10,636	$11,185	$2,178	$7,430	$15,026	$1,852	$5,889	$72,142
	9	*16*	*10*	*16*	*30*	*2*	*27*	*122*
Guiana, British	$965	$1,875	$1,271	$2,138	$7,635	$1,219	$5,328	$22,482
	5	*3*	*3*	*10*	*1*	*2*	*3*	*30*
Dutch	$698	$297	$229	$1,395	$572	$214	$1,446	$6,754
	1	*1*	.....	.....	.....	.....	*2*	*5*
French	$96	$94	.....	.....	.....	.....	$277	$563
	8	.....	*1*	.....	.....	.....	.....	*26*
Paraguay	$3,042	.....	$69	.....	.....	.....	.....	$6,236
	61	*17*	*23*	*73*	*60*	*29*	*50*	*355*
Peru	$14,835	$5,052	$8,537	$38,316	$45,003	$63,569	$76,646	$263,005
	27	*19*	*24*	*14*	*8*	*15*	*25*	*156*
Uruguay	$3,749	$2,205	$3,808	$1,574	$1,128	$2,207	$7,146	$24,848
	52	*53*	*28*	*46*	*21*	*26*	*9*	*267*
Venezuela	$4,184	$4,808	$2,970	$9,599	$3,989	$2,804	$3,810	$35,492
ASIA:	*2*	.....	*1*	.....	*1*	.....	.....	*4*
Aden	$604	.....	$64	.....	$148	.....	.....	$816
	38	*29*	*25*	*48*	*44*	*57*	*117*	*397*
China	$19,330	$8,280	$7,618	$16,660	$36,107	$56,851	$79,597	$243,473
	1	.....	.....	*15*	*2*	.....	.....	*20*
Kwantung: (Leased Territory)	$44	.....	.....	$1,389	$180	.....	.....	$1,800
	.....	.....	.....	.....	.....	*1*	.....	*1*
Chosen	.....	.....	.....	.....	.....	$1,285	.....	$1,285
East Indies:	*86*	*179*	*165*	*165*	*259*	*46*	*102*	*1,097*
British India	$12,532	$18,208	$15,679	$26,166	$130,745	$26,291	$107,675	$348,542
	88	*52*	*52*	*112*	*118*	*95*	*34*	*596*
Straits Settlements	$9,361	$3,552	$6,209	$14,914	$22,220	$19,523	$16,175	$107,223
	3	*11*	.....	*10*	.....	.....	*8*	*53*
Other British	$708	$715	.....	$918	.....	.....	$5,657	$8,298
	22	*6*	*12*	*56*	*106*	*22*	*192*	*443*
Dutch	$3,051	$647	$1,262	$11,862	$24,819	$11,505	$91,621	$149,126
	.....	.....	.....	.....	.....	.....	*15*	*13*
French	.....	.....	.....	.....	.....	.....	$2,588	$2,588
	19	*4*	*15*	*2*	*11*	*10*	*73*	*141*
Hongkong	$3,115	$853	$2,715	$171	$25,691	$12,177	$54,466	$106,146
	52	*15*	*29*	*54*	*154*	*129*	*453*	*946*
Japan	$16,466	$3,548	$8,386	$10,962	$33,242	$43,202	$108,796	$242,605
	1	.....	.....	.....	.....	*2*	.....	*3*
Persia	$100	.....	.....	.....	.....	$2,987	.....	$3,087
	25	*4*	*14*	*2*	.....	.....	*15*	*66*
Russia in Asia	$3,006	$274	$347,582	$352	.....	.....	$90,392	$442,988
	11	*25*	*42*	*32*	*45*	*35*	*82*	*277*
Siam	$1,293	$2,290	$4,269	$5,132	$10,655	$12,541	$71,365	$108,516
	13	.....	*1*	.....	.....	.....	*9*	*35*
Turkey in Asia	$1,493	.....	$748	.....	.....	.....	$1,868	$5,535
OCEANIA, BRITISH:	*1,001*	*608*	*735*	*706*	*315*	*309*	*456*	*5,870*
Australia	$150,214	$85,517	$96,498	$87,120	$55,674	$40,617	$84,289	$862,328
	124	*144*	*98*	*94*	*36*	*6*	*125*	*1,080*
New Zealand	$21,583	$20,338	$20,648	$23,962	$15,777	$6,861	$19,427	$247,020
	19	*26*	*4*	*17*	*26*	*16*	*27*	*185*
Other British	$7,450	$6,001	$1,338	$11,880	$5,437	$5,759	$11,612	$69,826
	22	*2*	*4*	*8*	*24*	*13*	*15*	*112*
French	$27,151	$2,490	$6,130	$11,609	$9,875	$12,663	$14,370	$103,715
	7	*1*	.....	*1*	*11*	*3*	*6*	*44*
German	$2,928	$550	.....	$1,000	$14,788	$6,500	$3,060	$33,493
Philippine Islands	*164*	*91*	*17*	*188*	*73*	*108*	*447*	*1,185*
	$22,915	$20,137	$4,319	$32,522	$40,075	$32,543	$316,169	$494,482
AFRICA:	.....	.....	.....	.....	.....	.....	*1*	*1*
Belgian Kongo	.....	.....	.....	.....	.....	.....	$200	$200
British Africa:	*13*	*1*	*4*	*8*	*4*	*7*	*16*	*54*
West	$1,241	$70	$300	$869	$583	$1,264	$6,887	$11,306
	97	*108*	*130*	*82*	*15*	*14*	*100*	*706*
South	$15,394	$12,134	$31,897	$12,334	$2,079	$5,807	$21,197	$125,238
	.....	*4*	*1*	*17*	.....	*1*	*3*	*26*
East	.....	$696	$69	$2,854	.....	$385	$1,511	$5,515
	5	*3*	*5*	*2*	.....	.....	*8*	*29*
Canary Islands	$309	$732	$1,257	$156	.....	.....	$17,495	$22,132
	15	.....	*4*	*8*	.....	.....	*14*	*49*
Egypt	$990	.....	$325	$795	.....	.....	$3,376	$7,551
	8	*8*	*4*	*2*	*4*	.....	*40*	*67*
French Africa	$2,578	$930	$1,490	$200	$435	.....	$4,328	$10,022
	21	.....	.....	.....	.....	.....	.....	*22*
German Africa	$1,676	.....	.....	.....	.....	.....	.....	$3,032
	2	.....	.....	.....	.....	.....	.....	*2*
Italian Africa	$190	.....	.....	.....	.....	.....	.....	190
	5	.....	*1*	.....	*1*	.....	*12*	*19*
Liberia	$499	.....	$90	.....	$190	.....	$1,041	$1,820
	.....	.....	*1*	.....	.....	*1*	*1*	*3*
Madagascar	.....	.....	$239	.....	.....	$100	$462	$801
	1	.....	*6*	.....	.....	.....	*5*	*13*
Morocco	$95	.....	$796	.....	.....	.....	$6,202	$7,277
	56	*5*	*11*	*9*	*2*	*3*	*9*	*108*
Portuguese Africa	$6,516	$2,593	$938	$1,624	$706	$458	$3,914	$19,306
	5	.....	.....	.....	.....	.....	.....	*6*
Spanish Africa	$585	.....	.....	.....	.....	.....	.....	$747
Number	.....	.....	.....	.....	.....	.....	.....	*75,297*
Grand Total Value	.....	.....	.....	.....	.....	.....	.....	$22,729,900
	5,460	*1,676*	*3,142*	*4,222*	*1,460*	*409*	*4,104*	*30,331*
EUROPE	$561,577	$196,995	$580,455	$849,666	$966,271	$570,534	$3,060,814	$7,799,079
	3,248	*2,479*	*2,982*	*3,181*	*4,001*	*1,312*	*3,513*	*25,933*
NORTH AMERICA	$523,602	$303,600	$1,948,292	$942,886	$1,005,940	$477,075	$1,122,261	$7,319,955
	972	*428*	*497*	*774*	*520*	*218*	*484*	*5,471*
SOUTH AMERICA	$180,768	$62,310	$68,342	$136,095	$151,466	$151,216	$564,855	$1,683,329
	561	*329*	*357*	*496*	*740*	*394*	*1,099*	*4,073*
ASIA	$71,103	$38,373	$394,532	$88,526	$283,808	$185,077	$630,585	$1,764,129
	1,337	*866*	*857*	*1,014*	*480*	*455*	*1,076*	*8,476*
OCEANIA	$232,241	$135,043	$128,933	$168,109	$141,626	$104,943	$448,927	$1,810,883
	228	*129*	*167*	*128*	*24*	*26*	*209*	*1,105*
AFRICA	$30,073	$17,155	$19,401	$18,832	$3,993	$8,014	$66,613	$197,137

plan being to provide an opening in the heating chamber, normally covered with a flange plate, and through which the flame from a blow lamp can be made to provide the initial heating for starting from cold on kerosene.

Magneto ignition is universal, the battery type only occurring in a few cases as a supplementary ignition system.

In regard to lubrication, it is almost impossible to classify the various systems adopted. The hollow shaft system is increasing in favor, but despite this there are many firms still depending entirely upon drip feed and splash. The circulating splash system frequently includes direct leads to the main crankshaft journals, while in one type the flywheel is made use of to lift the oil from the sump to gutters carrying it to troughs under the big-ends and to others over the journals.

The conditions under which marine motors are operated, and the advisability of designing them so that they can be almost completely dismantled without disturbing the base, has induced British manufacturers to arrange subsidiary details and drives, for example, oil and water pumps, exterior to and separate from the crankcase. There is no doubt that in this connection careful consideration has been given to convenience in upkeep rather than to neatness in appearance; the majority of engines have large flange-covered hand-holes in the crankcase through which the big-ends can be reached and the pistons and connecting rods withdrawn.

It will be surmised from the foregoing that the submerged type of oil pump is quite exceptional, this unit being generally arranged well above the crankshaft axis and driven either by chain from the crankshaft or from an extension of the camshaft. Oil filtration is usually thorough, and the system provides means of readily removing filters for cleaning purposes without draining off the main supply of oil.

In circulating oil systems, the lubricant is usually cooled by carrying a water pipe through the crankcase sump in the run from the water inlet to the pump. Some makers go so far as to give this pipe several coils in its passage through the oil, so as to expose a large cooling area to the lubricant.

In one of the Brooke series, the oil in course of circulation is passed through a jacket of the induction manifold, thus serving a double purpose—cooling the oil and assisting vaporisation.

In regard to crankcase and cylinder construction, the detachable head is very rarely seen, the cylinders usually being cast separately or in pairs, and being integral units of cast iron bolted to the top of the cast iron crankcase. In most designs the latter is divided transversely in the longitudinal center line of the crankshaft, but in one or two cases the crankchamber is cast as a unit, the crankshaft being assembled through a large hole at the rear end and supported at that point by a detachable endplate which forms the bearing housing.

Non-Ferrous Metal Specifications

(*Continued from page* 329)

Specification No. 67, Semi-Plastic Bronze

Composition in percentage:

Copper	75.50 to 78.50
Tin	7.25 to 8.75
Lead	13.50 to 16.50
Zinc, max.	0.50
Phosphorus, max.	0.25
Iron, max.	0.25
Antimony, max.	0.50
Aluminum	None
Impurities, max.	0.75

General Information

Good castings made of this alloy should give the following minima in physical characteristics:

Ultimate strength, lb. per sq. in.	20,000
Elongation in 2 in. or proportionate length, per cent	10

This metal is intended for use where a soft bronze with good anti-friction qualities is desired.

Storage Battery Specifications

(Excerpts from the Report of the S.A.E. Standards Committee)

Ratings—Batteries for combined starting and lighting service shall have two ratings. The first rating shall indicate the lighting ability and shall be the capacity in ampere-hours when the battery is discharged continuously at the 5-hr. rate to a final voltage of not less than 1.7 per cell, the temperature of the battery beginning such discharge being 80 deg. fahr. The second rating shall indicate the starting ability and shall be the capacity in ampere-hours when the battery is discharged continuously at the 20-min. rate to a final voltage of not less than 1.5 per cell, the temperature of the battery beginning such discharge being 80 deg. fahr.

Terminal Posts.—When taper posts are used for terminals of lead-acid storage batteries, the dimensions in inches shall be

Small diameter of the negative post	5/8
Small diameter of the positive post	11/16
Taper per foot	1-1/3
Minimum length of taper	11/16

When straight terminal posts are used, the diameter of both the positive and negative posts shall be 13/16 in. and the minimum clear length of the post shall be 13/16 in.

These dimensions refer to batteries for lighting service as well as for combined starting and lighting service.

Compartments.—Compartments for starting and lighting batteries shall be of metal not less than 18 United States plate gage (0.050 in.) in thickness, supported entirely by the chassis.

Battery compartments shall be 8 in. wide and 10⅛ in. high in order to give a ¼-in. clearance all around the battery. End-to-end assembly of jars is not recommended on account of the inherent weakness of this type of construction.

The battery shall rest on two wooden strips each 2 in. wide by ¼-in. thick, running lengthwise of the compartment. These **shall be positively spaced with the edges** flush with the sides of the battery. Spacers **shall be provided to give a ¼-in. space at** each side of the battery and a 1½-in. space at each end outside of the hold-down devices.

The compartment shall be drained and ventilated.

The hold-down devices should be attached at the level of the top of the battery, not to the top of the handles.

Recommended Practice in Testing Spark Plugs

(Excerpts from the report of the S. A. E. Standards Committee)

A sufficient number of sample spark-plugs drawn at random from stock are to be fur-

(*Continued on page* 385)

Motor Boat Exports,

	1914	1915	1916	1917	1918	July 1 to Dec. 30 1918	1919	1920	Total
EUROPE:									
Austria-Hungary	5 $5,022	.....	.....	.....	.....	.....	.....	.....	5 $5,022
Azores and Madeira Islands	1 $1,162	.....	.....	.....	.....	.....	.....	.....	1 $1,162
Belgium	.....	.....	.....	.....	.....	.....	1	1 $900	1 $900
Denmark	.....	.....	.....	2 $1,554	.....	.....	1 $2,500	.....	3 $4,054
France	.....	.....	.....	2 $932	2 $2,400	.....	.....	.....	4 $3,332
Germany	17 $3,429	1 $110	.....	.....	.....	.....	.....	.....	18 $3,539
Gibraltar	1 $316	.....	.....	.....	.....	.....	.....	.....	1 $316
Greece	.....	.....	.....	.....	.....	.....	1 $2,500	2 $2,230	3 $4,730
Italy	2 $1,280	.....	.....	7 $246,000	72 $2,080,800	50 $2,000,000	1 $2,000	.....	132 $4,330,080
Iceland and Faroe Islands	.....	.....	.....	.....	.....	1 $400	.....	.....	1 $400
Netherlands	.....	1 $284	3 $2,685	1 $925	.....	.....	.....	2 $6,200	7 $10,094
Norway	3 $4,400	.....	3 $4,815	4 $7,950	1 $3,000	2 $3,349	.....	.....	13 $23,514
Portugal	.....	1 $221	.....	.....	.....	.....	4 $2,351	4 $42,815	9 $45,387
Russia in Europe	11 $6,158	.....	18 $387,325	16 $376,000	10 $117,500	.....	.....	.....	55 $886,983
Spain	4 $11,748	1 $270	1 $189	4 $5,417	1 $999	.....	3 $3,794	32 $62,735	46 $85,152
Sweden	1 $750	1 $200	.....	.....	.....	.....	1 $390	.....	3 $1,340
Turkey in Europe	1 $2,625	1 $1,350	.....	.....	.....	.....	.....	4 $12,560	6 $17,535
United Kingdom:									
England	8 $20,804	4 $21,166	10 $78,807	1 $8,160	1 $1,200	.....	.....	3 $75,000	27 $205,137
Scotland	1 $283	.....	.....	.....	.....	.....	.....	.....	1 $283
NORTH AMERICA:									
Bermuda	4 $2,340	1 $600	1 $85	2 $2,875	.....	.....	2 $1,300	2 $7,500	12 $23,115
British Honduras	4 $3,350	.....	1 $1,000	1 $300	.....	.....	.....	.....	6 $4,650
Canada	91 $39,045	45 $23,387	24 $10,569	54 $42,775	22 $27,296	20 $33,924	23 $10,458	18 $12,552	297 $200,006
Central America:									
Costa Rica	5 $9,067	2 $757	.....	2 $3,118	.....	.....	.....	.....	9 $12,942
Guatemala	4 $2,684	1 $1,730	2 $4,829	.....	.....	.....	.....	1 $3,500	8 $12,743
Honduras	3 $5,550	4 $2,360	.....	.....	.....	1 $1,450	4 $4,760	2 $2,094	14 $16,214
Nicaragua	8 $5,875	3 $1,465	3 $2,438	3 $4,230	3 $3,750	1 $9,000	3 $1,460	2 $4,114	26 $32,332
Panama	17 $52,553	6 $14,184	91 $26,243	18 $50,855	6 $5,538	.....	10 $29,355	7 $50,160	155 $228,888
Salvador	3 $3,497	2 $2,003	1 $200	1 $360	1 $4,750	.....	.....	1 $1,100	9 $11,910
Mexico	56 $123,545	23 $115,516	11 $16,595	29 $32,513	36 $111,630	8 $21,498	17 $48,782	44 $171,206	224 $641,285
Newfoundland, Labrador, etc.	.....	1 $3,000	1 $74	.....	.....	.....	1 $75	1 $1,200	4 $4,349
West Indies: British:									
Barbados	2 $113	.....	.....	.....	1 $1,500	.....	.....	.....	3 $1,613
Jamaica	4 $1,289	1 $170	1 $475	.....	.....	.....	1 $2,400	2 $2,050	9 $6,384
Trinidad	.....	.....	.....	1 $600	.....	.....	1 $153	.....	2 $750
Other British	6 $4,028	1 $240	7 $12,515	2 $5,200	2 $1,650	.....	1 $1,100	2 $7,000	21 $31,733
Cuba	16 $18,539	11 $6,724	23 $20,556	16 $37,048	7 $5,301	4 $13,800	5 $7,882	36 $118,031	122 $227,881
Dominican Republic	9 $12,016	2 $738	6 $2,200	1 $700	3 $2,210	.....	2 $845	7 $7,111	30 $25,820
Dutch	.....	.....	1 $3,500	.....	.....	.....	5 $2,800	.....	6 $6,300
French	2 $2,085	2 $3,960	2 $9,100	3 $6,350	1 $462	.....	1 $941	1 $1,237	12 $24,135
Haiti	1 $500	1 $182	2 $4,538	4 $2,833	.....	1 $1,700	2 $1,100	1 $1,200	12 $12,053
Virgin Islands	.....	.....	.....	.....	.....	.....	1 $350	.....	1 $350
SOUTH AMERICA:									
Argentina	12 $8,662	1 $2,708	.....	.....	2 $2,496	.....	.....	6 $8,856	21 $22,722
Bolivia	.....	.....	.....	.....	.....	1 $2,500	.....	.....	1 $2,500
Brazil	14 $13,518	7 $2,209	9 $7,136	6 $12,827	4 $4,575	.....	6 $41,275	8 $13,170	54 $94,710
Chile	8 $8,035	3	5 $5,142	5 $8,911	8 $18,788	2 $6,600	2 $2,935	2 $4,046	30 $54,457
Colombia	9 $96,417	9 $26,810	6 $5,482	3 $7,305	3 $19,933	1 $2,500	7 $21,806	19 $59,041	57 $239,294
Ecuador	6 $4,497	5 $1,303	2 $1,052	3 $1,434	1 $335	1 $697	.....	1 $3,850	19 $13,168

1914 to 1920

	1914	1915	1916	1917	1918	July 1 to Dec. 30 1918	1919	1920	Total
Guiana:									
British	*1*	.....	*2*	*1*	*1*	.....	*1*	.....	*6*
	$40	.....	$1,512	$550	$6,000	.....	$1,200	.....	$9,302
Dutch	*1*	.....	*1*	*3*	*2*	*2*	*1*	*2*	*12*
	$608	.....	$6,000	$8,363	$3,000	$21,000	$300	$10,425	$49,696
French	.....	.....	.....	.....	.....	.....	.....	*1*	*1*
	.....	.....	.....	.....	.....	.....	.....	$3,000	$3,000
Paraguay	*3*	.....	.....	.....	.....	.....	.....	.....	*3*
	$1,800	.....	.....	.....	.....	.....	.....	.....	$1,800
Peru	*5*	*4*	*3*	*3*	*6*	*2*	*11*	*14*	*49*
	$12,844	$14,901	$6,914	$8,543	$11,531	$5,500	$5,362	$76,072	$141,667
Uruguay	*7*	.....	.....	.....	*1*	.....	.....	.....	*8*
	$3,652	.....	.....	.....	$585	.....	.....	.....	$4,237
Venezuela	*5*	*1*	.....	*5*	*4*	.....	*1*	*4*	*20*
	$4,155	$5,123	.....	$12,870	$4,060	.....	$6,000	$5,000	$37,208
ASIA:									
Aden	*1*	.....	.....	.....	.....	.....	.....	*1*	*2*
	$750	.....	.....	.....	.....	.....	.....	$1,750	$2,500
China	.....	*2*	*1*	*2*	*2*	.....	.....	*3*	*10*
	.....	$590	$3,500	$536	$1,089	.....	.....	$5,003	$10,718
French China	*1*	.....	.....	.....	.....	.....	.....	.....	*1*
	$350	.....	.....	.....	.....	.....	.....	.....	$350
East Indies: British:									
British India	*6*	*5*	.....	*12*	*3*	.....	*1*	*10*	*37*
	$1,247	$2,073	.....	$7,127	$2,025	.....	$635	$8,991	$22,098
Straits Settlement	*5*	.....	.....	.....	.....	.....	*2*	*6*	*13*
	$2,222	.....	.....	.....	.....	.....	$1,156	$3,923	$7,301
Other British	.....	.....	.....	.....	.....	.....	*1*	.....	*1*
	.....	.....	.....	.....	.....	.....	$857	.....	$857
Dutch	*1*	*1*	*3*	*1*	*3*	.....	.....	.....	*9*
	$639	$2,500	$641	$365	$804	.....	.....	.....	$4,949
French	.....	.....	.....	.....	.....	.....	*1*	.....	*1*
	.....	.....	.....	.....	.....	.....	$2,150	.....	$2,150
Hongkong	.....	.....	.....	*1*	.....	.....	.....	.....	*1*
	.....	.....	.....	$300	.....	.....	.....	.....	$300
Japan	*4*	.....	*1*	.....	*1*	*6*	*2*	*2*	*16*
	$5,422	.....	$150	.....	$287	$1,864	$7,000	$1,700	$16,423
Russia in Asia	*2*	.....	*12*	.....	.....	.....	.....	*2*	*14*
	$775	.....	$159,833	.....	.....	.....	.....	$50,500	$211,108
Siam	.....	.....	*1*	.....	.....	*1*	.....	.....	*4*
	.....	.....	$145	.....	.....	$900	.....	.....	$1,045
Turkey in Asia	*1*	.....	.....	.....	.....	.....	.....	.....	*1*
	$260	.....	.....	.....	.....	.....	.....	.....	$260
OCEANIA: British:									
Australia	*5*	.....	*2*	.....	.....	.....	.....	*2*	*9*
	$1,134	.....	$303	.....	.....	.....	.....	$2,021	$3,458
New Zealand	*1*	.....	.....	*2*	.....	.....	.....	.....	*3*
	$200	.....	.....	$332	.....	.....	.....	.....	$434
Other British	.....	*1*	*1*	.....	*3*	.....	.....	.....	*5*
	.....	$1,282	$260	.....	$6,407	.....	.....	.....	$7,949
French	.....	.....	.....	*1*	*1*	.....	*1*	.....	*3*
	.....	.....	.....	$265	$1,000	.....	$150	.....	$1,415
Philippine Islands	*1*	*4*	*2*	.....	.....	.....	*2*	.....	*9*
	$2,650	$5,500	$12,500	.....	.....	.....	$5,050	.....	$25,700
AFRICA:									
Belgian Congo	*1*	*1*	.....	.....	.....	.....	*1*	*2*	*5*
	$414	$1,700	.....	.....	.....	.....	$115,000	$16,392	$133,506
British Africa:									
West	*2*	*2*	.....	*1*	.....	.....	*1*	*9*	*15*
	$1,294	$3,600	.....	$8,500	.....	.....	$5,000	$14,792	$33,189
South	*2*	.....	*3*	*3*	.....	.....	*7*	*17*	*32*
	$375	.....	$925	$431	.....	.....	$7,679	$14,186	$23,596
East	*1*	*1*	.....	.....	*2*	.....	.....	.....	*4*
	$802	$1,500	.....	.....	$827	.....	.....	.....	$3,129
Canary Islands	*1*	.....	.....	.....	.....	.....	.....	.....	*1*
	$369	.....	.....	.....	.....	.....	.....	.....	$369
Egypt	*2*	.....	.....	*1*	.....	.....	.....	*1*	*4*
	$1,750	.....	.....	$457	.....	.....	.....	$758	$2,965
French Africa	.....	.....	.....	*3*	.....	.....	*1*	.....	*4*
	.....	.....	.....	$1,432	.....	.....	$4,500	.....	$5,932
Liberia	*1*	*1*	.....	.....	.....	.....	.....	.....	*2*
	$178	$1,100	.....	.....	.....	.....	.....	.....	$1,278
Madagascar	.....	.....	.....	.....	.....	.....	.....	*3*	*3*
	.....	.....	.....	.....	.....	.....	.....	$5,140	$5,140
German Africa	.....	.....	.....	.....	.....	.....	*1*	.....	*1*
	.....	.....	.....	.....	.....	.....	$3,500	.....	$3,500
Portuguese Africa	*2*	.....	.....	.....	*2*	.....	.....	*7*	*11*
	$472	.....	.....	.....	$6,855	.....	.....	$8,761	$16,088
TOTALS	*400*	*164*	*264*	*230*	*218*	*104*	*140*	*298*	*1,821*
	$519,584	$273,516	$800,231	$917,438	$2,460,583	$2,126,682	$358,851	$1,008,872	$8,465,757

RECAPITULATION

EUROPE	*55*	*10*	*35*	*37*	*87*	*53*	*11*	*49*	*337*
	$57,977	$23,601	$473,821	$646,938	$2,205,899	$2,003,749	$13,535	$202,440	$5,627,960
NORTH AMERICA	*235*	*108*	*177*	*137*	*82*	*35*	*79*	*127*	*980*
	$286,076	$177,016	$114,915	$189,757	$164,087	$81,372	$113,761	$490,055	$1,615,039
SOUTH AMERICA	*71*	*28*	*26*	*29*	*32*	*9*	*29*	*57*	*281*
	$154,228	$53,054	$33,238	$61,003	$71,303	$38,797	$78,878	$183,460	$673,961
ASIA	*21*	*8*	*18*	*16*	*9*	*7*	*7*	*24*	*110*
	$11,665	$5,163	$164,269	$8,323	$4,205	$2,764	$11,798	$71,867	$280,054
OCEANIA	*7*	*5*	*5*	*3*	*4*	.....	*3*	*2*	*29*
	$3,984	$6,782	$13,063	$597	$7,407	.....	$5,200	$2,021	$39,054
AFRICA	*11*	*5*	*3*	*8*	*4*	.....	*11*	*39*	*81*
	$5,654	$7,900	$925	$10,820	$7,682	.....	$135,679	$60,029	$228,689

Recommended Practice in Testing Spark Plugs

(*Continued from page* 384)

nished to equip at least two of the engines under consideration.

The spark-plugs submitted for test must conform in all important dimensions to the engine builder's drawings.

Preignition and leakage tests are to be made in the following manner: An engine of the type for which the plugs are intended shall be equipped with a set of the spark-plugs to be tested. The spark-plug gaps shall be carefully adjusted with a suitable thickness gage to the desired dimension and these gaps shall not be disturbed throughout the tests. The engine shall then be coupled to a suitable dynamometer and the circulating water maintained at a temperature of not less than 40 deg. fahr. or more than 60 deg fahr. The engine shall then be started up and as rapidly as possible brought to the speed corresponding to the maximum torque, the throttle and the spark adjusted for this condition, and the circulating water temperature brought up to a temperature of not less than 190 deg. fahr. nor more than 210 deg. fahr. as rapidly as possible and this temperature maintained for the remainder of the run. Torque and speed readings shall then be taken at 30-sec. intervals for a period of 15 min. Appreciable loss of torque or speed, missing or backfiring which can be attributed to the spark-plugs, will be considered grounds for rejecting the spark-plugs under test, provided the engine is of proved design and has previously demonstrated its ability to run steadily under these conditions. During this run tests for gas leakage shall be made by covering all joints of the spark-plugs with oil and inspecting for leaks.

Following this 15-min. run at the speed corresponding to maximum torque, the engine shall be brought up to the speed corresponding to maximum horsepower and be held at this speed for not less than 5 min. Observations similar to those mentioned above are to be made during this run.

Spark-plugs shall also be subjected to road tests to determine how well they will function under normal service conditions.

Spark-plugs which have successfully passed the above tests will be considered satisfactory for use in so far as the following points are concerned:

(1) Breakage owing to sudden temperature changes.
(2) Liability to cause preignition.
(3) Leakage.
(4) Power performance.
(5) Permanence of gap.

The following procedure for determining the relative susceptibility of the spark-plugs under test to fouling is intended to serve merely as a guide in making such tests, since general engine influences and more particularly lubrication and carburetion conditions varying as they do in different makes of engine, prohibit the setting of one strictly standard method applicable to all engines.

The engine equipped with the spark-plugs under test shall be run on the dynamometer with the circulating water at not less than 40 deg. fahr. nor more than 60 deg. fahr. The inlet manifold shall be kept at as low a temperature as practicable, all heating means being disconnected so far as possible. The engine shall be run with no load and a wide-open throttle, the speed being held down to between 1000 and 1500 r.p.m. by causing the carbureter to feed an abnormally rich mixture. The engine shall be run in this manner for 3 min., following which the carbureter adjustment shall be restored to standard condition and the load applied to hold the engine at a speed of about 1200 r.p.m. It is assumed that the torque which is to be expected of the engine under test at this speed, has been previously determined. At the end of 2 min. running after applying the load as above explained, the percentage of standard torque which the engine is capable of developing will be considered as a figure of merit for the spark-plugs under test. For instance, if at the end of 2 min. operation under load following the "choked" run, the engine is capable of pulling its standard torque, the spark-plugs shall be considered 100 per cent satisfactory in this regard. If, however, the engine pulls but one-half its regular torque, the figure of merit will be 50. These tests should be repeated a sufficient number of times to insure a consistent average result.

Specifications of British Marine Engines

(Compiled for Automotive Industries by M. W. Bourdon.)

Make	No. of Cylinders	Bore and Stroke, Inches	Fuel	Normal R.P.M.	Impulse Starter	Lubrication System	Valve Arrgt.	Starting By	Governor	Type of Water Pump	Type of Oil Pump	Weight Engine Only Lb.
Ailsa Craig	2	5 x5½	Ker.	900	Yes.	Press.	L	Hc.	Yes.	Pist.	Gears	720
Ailsa Craig	4	5 x5½	Ker.	900	Yes.	Press.	L	Hc.	Yes.	Pist.	Gears	1000
Ailsa Craig	6	5 x5½	Ker.	900	Yes.	Press.	L	Hc.	Yes.	Pist.	Gears	1400
Ailsa Craig	1	4⅝x6	Ker.	900	Yes.	Press.	L	Hc.	Yes.	Pist.	Plun.	560
Ailsa Craig	3	4⅝x6	Ker.	900	Yes.	Press.	L	Hc.	Yes.	Gear.	Gear.	1100
Aster	4	2⅜x3⅛	Gas. or ker.	1100	No.	Circ. spl.	L	Hc. or elec.	Yes.	Gear.	Gear.	500
Aster	2	3½x4¾	Gas. or ker.	900	No.	Press.	L	Hc. or elec.	Yes.	Gear.	Gear.	600
Aster	4	3½x4¾	Gas. or ker.	900	No.	Press.	L	Hc. or elec.	Yes.	Gear.	Gear.	900
Aster	2	4⅜x5½	Gas. or ker.	900	No.	Press.	L	Hc. or elec.	Yes.	Gear.	Gear.	750
Aster	4	4⅜x5½	Gas. or ker.	900	No.	Press.	L	Hc. or elec.	Yes.	Gear.	Gear.	1300
Aster	4	5¼x6	Gas. or ker.	900	No.	Press.	L	Hc. or elec.	Yes.	Gear.	Gear.	1650
Aster	8	5¼x6	Gas. or ker.	900	No.	Press.	L	Hc. or elec.	Yes.	Gear.	Gear.	2800
Atlantic	2	½x7	Ker.	550	Yes.	Drip & Spl.	L	Hc.	Yes.	Pist.	None	970
Atlantic	4	5½x7	Ker.	550	Yes.	Drip & Spl.	L	Hc.	Yes.	Pist.	None	1340
Atlantic	4	4 x5	Ker.	1000	Yes.	Drip & Spl.	L	Hc.	Yes.	Pist.	None	845
Atlantic	4	6 x8	Ker.	550	Yes.	Drip & Spl.	L	Hc.	Yes.	Pist.	None	1950
Atlantic	6	6 x8	Ker.	550	Yes.	Drip & Spl.	L	Hc.	Yes.	Pist.	None	2100
Brooke*	1	3⅜x3¼	Gas.	850	No.	Spl.		Hc.	No.	Plun.	None	140
Brooke	1	3⅜x4¼	Gas. or ker.	950	Opt.	Spl.	T	Hc.	Yes.	Eccen.	None	200
Brooke	2	3⅜x4¾	Gas. or ker.	950	Opt.	Circ. spl.	T	Hc.	Yes.	Eccen.	Gear	400
Brooke	3	3⅜x4¾	Gas. or ker.	950	Opt.	Circ. spl.	L	Hc.	Yes.	Eccen.	Gear	600
Brooke	4	3⅜x4¾	Gas. or ker.	950	Opt.	Circ. spl.	T	Hc.	Yes.	Eccen.	Gear	920
Brooke	6	3⅜x4¾	Gas. or ker.	1200	Opt.	Circ. spl.	L	Hc.	Yes.	Eccen.	Gear	1100
Brooke	2	5½x6	Gas. or ker.	1000	Opt.†	Circ. spl.	T	Hc.	Yes.	Eccen.	Gear	1100
Brooke	4	5½x6	Gas. or ker.	1000	Opt.†	Circ. spl.	T	Hc.	Yes.	Eccen.	Gear	1750
Brooke	6	5½x6	Gas. or ker.	1000	Opt.†	Circ. spl.	T	Hc.	Yes.	Eccen.	Gear	2050
Day*	1	3¼x3¼	Gas.	900	No.	Drip.		Hc.	No.	Gear	None	75
Day*	1	4½x4½	Gas.	850	No.	Drip.		Hc.	No.	Gear	None	175
Day*	2	4½x4½	Gas.	850	No.	Drip.		Hc.	No.	Gear	None	300
Day*	2	4¾x5	Gas.	800	No.	Drip.		Hc.	No.	Gear	None	450
Dixon	1	3½x3½	Gas. or ker.	950	Yes.	Press.	F	Hc.	Yes.	Gear	Gear	180
Dixon	2	3½x3½	Gas. or ker.	950	Yes.	Press.	F	Hc.	Yes.	Gear	Gear	392
Dixon	4	3½x3¼	Gas. or ker.	950	Yes.	Press.	F	Hc.	Yes.	Gear	Gear	700
Dixon	1	4¾x6½	Ker.	900	Yes.	Press.	T	Hc.	Yes.	Gear	Gear	630
Dixon	2	4¾x6½	Ker.	900	Yes.	Press.	T	Hc.	Yes.	Gear	Gear	830
Dixon	3	4¾x6½	Ker.	900	Yes.	Press.	T	Hc.	Yes.	Gear	Gear	1200
Dixon	4	4¾x6½	Ker.	900	Yes.	Press.	T	Hc.	Yes.	Gear	Gear	1450
Dixon	6	4¾x6½	Ker.	900	Yes.	Press.	T	Hc.	Yes.	Gear	Gear	1900
Dixon	4	6 x6½	Ker.	950	Yes.	Press.	F	Hc.	Yes.	Gear	Gear	2070
Dixon	6	6 x6½	Ker.	950	Yes.	Press.	F	Hc.	Yes.	Gear	Gear	2800
Djinn	1	4 x5	Ker.	1100	No.	Spl.	L	Hc.	No.	Gear	None	220
Djinn	2	4½x6	Ker.	800	No.	Circ. spl.	L	Hc.	No.	Pist.	Pist.	900
Djinn	2	6½x8¾	Ker.	500	No†	Circ. spl.	L	Hc.	Yes.	Pist.	Pist.	3920
Djinn	4	6½x7½	Ker.	650	No†	Press.	L	Hc.	No.	Pist.	Pist.	3900
Djinn	6	6½x8¾	Ker.	600	No†	Press.	L	Hc.	No.	Pist.	Pist.	7800
Fyfe Wilson	4	2⅝x4⅜	Gas. or ker.	1000	No.	Press.	L	Hc.	No.	Eccen.	Gear	280
Fyfe Wilson	4	3½x5	Gas. or ker.	1000	No.	Press.	L	Hc.	Yes.	Gear	Plun.	450
Gardner	4*	4½x4½	Ker.	1000	No.	Circ. spl.	F	Hc.	Yes.	Gear	Gear	650
Gardner	3*	8 x8½	Ker.	500	No.	Press.	T	Hc.	Yes.	Gear	Gear	5800
Gleniffer	2	4¼x5	Ker.	800	Yes.	Circ. spl.	L	Hc.	Yes.	Pist.	Disk	400
Gleniffer	4	5¾x7	Ker.	650	Yes.	Circ. spl.	L	Hc.	Yes.	Pist.	Flywh.	1900
Gleniffer	1	6 x8	Ker.	650	No.	Circ. spl.	L	Hc.	Yes.	Pist.	Flywh.	.....
Gleniffer	2	6 x8	Ker.	650	No.	Circ. spl.	L	Hc.	Yes.	Pist.	Flywh.	.....
Gleniffer	4	6 x8	Ker.	650	No.	Circ. spl.	L	Hc.	Yes.	Pist.	Flywh.	.....
Gleniffer	6	6 x8	Ker.	650	No.	Circ. spl.	L	Hc.	Yes.	Pist.	Flywh.	.....
Green	4	4⅜x4¾	Gas.	1200	No.	Press.	I	Elec.	No.	Gear	Gear	250
Green	6	5½x6	Gas.	1250	No.	Press.	I	Elec.	No.	Gear	Gear	590
Green	6	5½x7	Gas.	1200	No†	Press.	I	Elec.	No.	Gear	Gear	900
Green	12	5½x7	Gas.	1200	No†	Press.	I	Comp. air.	No.	Gear	Gear	1250
Green	18	5½x7	Gas.	1200	No†	Press.	I	Comp. air.	No.	Gear	Gear	1850
Parsons	1	4½x6	Ker.	850	No.	Press.	L	Elec. opt.	Opt.	Eccen.	Gear	420
Parsons	2	4½x6	Ker.	850	No.	Press.	L	Elec. opt.	Opt.	Eccen.	Gear	690
Parsons	3	4½x6	Ker.	850	No.	Press.	L	Elec. opt.	Opt.	Eccen.	Gear	800
Parsons	4	4½x6	Ker.	850	No.	Press.	L	Elec. opt.	Opt.	Eccen.	Gear	1100
Parsons	6	4½x6	Ker.	850	No.	Press.	L	Elec. opt.	Opt.	Eccen.	Gear	1400
Parsons	2	6½x8	Ker.	650	No†	Press.	L	Elec. opt.	Yes.	Eccen.	Pist.	2000
Parsons	3	6½x8	Ker.	650	No†	Press.	L	Elec. opt.	Yes.	Eccen.	Pist.	2400
Parsons	4	6½x8	Ker.	650	No†	Press.	L	Elec. opt.	Yes.	Eccen.	Pist.	3200
Parsons	6	6½x8	Ker.	650	No†	Press.	L	Elec. opt.	Yes.	Eccen.	Pist.	4400
McLaren	2	4 x5	Ker.	850	No.	Circ. spl.	L	Hc.	No.	Gear	Gear	500
McLaren	4	4 x5	Ker.	850	No.	Circ. spl.	L	Hc.	No.	Gear	Gear	890
McLaren	6	4 x5	Ker.	850	No.	Circ. spl.	L	Hc.	No.	Gear	Gear	1300
Spherota	1	4¼x5½	Ker.	1000	Yes.	Spl.	T	Hc.	No.	Cent.	None	340
Spherota	2	4¼x5½	Ker.	1000	Yes.	Spl.	T	Hc.	No.	Cent.	None	450
Spherota	4	4¼x5½	Ker.	1000	Yes.	Spl.	T	Hc.	No.	Cent.	None	680
Thorneycroft	2	4½x6	Ker.	1000	No.	Circ. spl.	L	Hc.	Yes.	Gear	Gear	900
Thorneycroft	4	4½x6	Ker.	1000	No.	Circ. spl.	L	Hc.	Yes.	Gear	Gear	1300
Thorneycroft	4	4 x5½	Ker.	1000	No.	Circ. spl.	F	Hc.	Yes.	Gear	Gear	1350
Thorneycroft	6	4 x7	Gas.	1400	No†	Circ. spl.	F	Hc.	No.	Gear	Gear	1150
Thorneycroft	4	6 x8	Ker.	750	No.	Circ. spl.	F	Hc.	Yes.	Gear	Gear	2800
Thorneycroft	6	6 x8	Ker.	750	No.	Circ. spl.	F	Hc.	Yes.	Gear	Gear	3900
Wasp	1	4⅛x6	Ker.	800	No.	Circ. spl.	I	Hc.	No.	Plun.	Plun.	330
Wasp	2	4⅛x6	Ker.	800	No.	Circ. spl.	I	Hc.	No.	Plun.	Plun.	530
Webber	2	4 x6	Gas. or ker.	950	No.	Press.	L	Hc.	No.	Plun.	Plun.	670
Wolseley	4	2⅞x3½	Gas.	1050	No.	Circ. spl.	F	Hc.	No.	Gear	Gear	220
Wolseley	4	3¾x4¾	Gas. or ker.	1000	No.	Circ. spl.	L	Hc.	No.	Gear	Gear	670
Wolseley	6	3¾x5⅝	Gas. or ker.	1000	No.	Circ. spl.	L	Hc.	No.	Gear	Gear	875
Wolseley	6	4¾x5¾	Gas. or ker.	1000	No.	Circ. spl.	L	Hc.	No.	Gear	Gear	1300
Watermota*	1	2⅝x2⅝	Gas (outboard)	800	No.	With fuel.		Flywh.	No.	Gear	None	60††
Watermota*	1	2¾x3	Gas (outboard)	800	No.	With fuel.		Flywh.	No.	Gear	None	100††
Watermota*	1	2¾x3	Gas (inboard)	800	No.	With fuel.		Hc.	No.	Plun.	None	50
Watermota*	2	2¾x3	Gas (inboard)	800	No.	With fuel.		Hc.	No.	Plun.	None	90

*Two stroke.
†Battery in addition to magneto; all engines have magnetos.
††Typical of range of 30 engines with 1 to 6 cylinders of 5 H.P. to 220 H.P.

ABBREVIATIONS: Circ—Circulating; **Comp**—Compressed; **Eccen**—Eccentric; **Elec**—Electric; **F**—Exhaust Valve Over Inlet in Pocket; **Gas**—Gasoline; †Complete Installation; **Hc**—Hand-crank; **I**—In Head; **Ker**—Kerosene; **L**—Side by Side (in L head); **Opt**—Optional; **Pist**—Piston; **Plun**—Plunger; **Press**—Pressure; **Spl**—Splash; **T**—In pockets at Both Sides (T. head).

Tire Exports, 1911 to 1920

	1911	1913	1914	1915	1916	1917	1918	July 1 to Dec 31, 1918	Calendar Year 1919	1920†	Total for All Yrs thru 1912
Austria-Hungary	$329	$299	$1,009	.....	.....	.....	.....	.....	$43,121	$224,087	$271,218
Azores and Madeira Islands	.....	.....	138	$178	$373	.....	$72	.....	.....	66,698	77,459
Belgium	821	401,909	15,730	.....	.....	.....	.....	$28,718	532,532	1,280,309	2,311,730
Bulgaria	.....	500	170	150	.....	.....	.....	.....	.....	3,570	4,390
Czechoslovakia	.....	.....	.....	.....	.....	.....	.....	.....	.....	154	154
Denmark	98	16,611	11,414	12,288	16,089	$6,917	.....	.....	1,254,324	959,241	2,277,250
Finland	.....	1,545	4,585	.....	.....	.....	.....	.....	23,367	440,157	469,694
France	185,473	20,205	5,448	8,723	80,423	425,132	661,648	425,149	3,535,178	2,369,018	8,033,026
Germany	29,979	401,196	132,181	6,090	.....	.....	.....	.....	33,280	576,714	1,180,500
Gibraltar	.....	.....	.....	.....	.....	.....	129	.....	175	43,028	43,332
Greece	.....	.....	271	2,680	698	34,654	2,000	.....	83,449	311,079	434,832
Iceland and Faroe Islands	.....	.....	.....	.....	.....	61	.....	.....	23,961	2,855	26,877
Italy	537	1,150	915	11,740	333,437	101,362	55,913	585	226,245	992,648	1,726,918
Malta, Gozo and Cyprus Islands	.....	.....	.....	.....	.....	.....	.....	.....	424	72,669	73,093
Netherlands	.....	424	2,286	1,907	36,548	26,326	215	.....	1,043,981	1,813,149	2,915,241
Norway	1,295	456	5,649	7,394	10,091	11,937	525	6,668	845,690	1,430,389	2,320,083
Poland and Danzig	.....	.....	.....	.....	.....	.....	.....	.....	.....	278,096	278,096
Portugal	693	282	157	1,434	25,990	9,055	15,488	4,388	176,303	367,321	501,382
Roumania	.....	146	211	.....	576	.....	.....	.....	70,785	590,620	662,512
Russia in Europe	655	729	1,168	6,480	1,125,748	143,916	94,264	211	1,402	13,569	1,388,127
Serbia, Montenegro and Albania	.....	.....	.....	.....	.....	.....	.....	.....	300	.....	300
Spain	3,547	567	1,595	2,408	32,984	77,753	12,233	20,899	825,007	1,925,185	2,902,178
Sweden	8,335	5,301	77,537	26,707	35,859	6,347	.....	18,825	1,373,847	2,619,103	4,179,497
Switzerland	.....	.....	.....	.....	.....	.....	.....	.....	220,052	628,659	848,711
Turkey in Europe	.....	.....	.....	1,927	.....	.....	.....	.....	85,334	215,834	303,095
England	1,104,416	1,125,718	1,503,440	2,655,099	9,175,243	2,569,901		78,573	1,508,460	4,178,548	25,695,153
Scotland	.....	.....	336	245	116,858	66,753	618,071	.....	263	144,294	328,749
Ireland	.....	.....	.....	.....	1,386	.....		.....	.....	2,220	3,763
Jugoslavia	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,674	16,674
North America:											
Bermuda	.....	401	267	139	1,440	14	409	.....	268	503	3,531
British Honduras	15	163	727	64	36	590	3,469	2,503	6,663	6,744	21,586
Canada	405,778	1,324,459	961,937	772,574	1,176,836	1,485,939	1,766,518	350,345	1,021,014	2,704,230	12,666,065
Newfoundland and Labrador	955	693	1,668	4,034	5,108	8,243	11,317	8,952	24,319	31,871	88,304
Miquelon, Langley, etc.	.....	.....	.....	.....	.....	.....	.....	.....	.....	20	20
Central American States:											
Costa Rica	951	2,793	6,877	2,381	6,968	11,918	4,018	4,505	12,301	15,568	69,243
Guatemala	1,343	2,224	5,547	3,406	6,299	24,545	7,089	15,642	64,981	61,776	194,980
Honduras	.....	299	1,392	3,229	7,932	19,657	19,602	8,813	35,489	26,455	123,270
Nicaragua	.....	429	180	419	157	294	1,042	2,743	32,075	26,480	63,949
Panama	5,379	19,466	18,362	24,549	73,854	74,047	137,309	51,959	416,637	482,641	1,308,576
Salvador	525	1,705	2,084	2,617	11,673	22,530	22,319	17,036	95,664	98,074	161,873
Mexico	144,893	203,883	111,948	106,083	236,811	257,413	777,984	566,442	805,614	1,438,777	4,798,327
West Indies, British:											
Barbados	1,227	4,588	4,351	4,136	6,019	15,666	19,391	20,385	31,026	31,813	140,221
Jamaica	11,614	30,004	55,361	36,887	40,354	109,048	109,097	76,099	156,822	271,381	915,952
Trinidad and Tobago	689	16,364	17,023	22,672	30,510	45,654	107,353	49,838	78,435	184,000	554,874
Other British	477	1,869	2,472	3,327	8,337	21,526	25,991	20,787	33,700	83,550	202,546
Cuba	27,072	12,322	55,236	192,355	547,410	1,019,915	1,336,233	929,796	2,013,071	3,409,986	9,565,110
Danish (Virgin Islands of U. S.)	.....	540	1,739	577	1,099	2,753	6,939	6,089	8,679	21,658	50,263
Dominican Republic	321	2,306	2,902	3,062	18,223	37,441	61,684	54,755	121,891	274,442	579,961
Dutch	30	767	746	3,068	4,437	7,386	9,084	8,190	10,390	24,137	68,358
French	.....	115	1,045	1,527	1,283	19,399	36,474	32,493	159,176	103,374	355,010
Haiti	.....	765	2,336	526	988	2,287	13,061	16,323	60,102	83,815	180,243
South America:											
Argentina	3,541	8,153	21,920	34,096	488,329	1,301,344	1,649,840	959,259	1,788,147	3,126,889	9,291,714
Bolivia	.....	106	1,526	3,413	4,954	9,187	20,513	22,558	24,191	31,974	118,422
Brazil	10,112	47,537	11,839	77,425	295,479	608,876	455,102	111,550	1,018,055	1,965,201	4,714,128
Chile	262	2,844	10,636	21,359	58,809	264,698	725,876	481,919	795,440	525,635	2,897,731
Colombia	2,564	16,211	18,925	15,236	28,617	29,298	54,648	20,276	124,238	183,859	509,143
Ecuador	392	8,459	3,313	8,620	9,225	13,645	46,305	20,052	77,189	52,297	240,112
Falkland Islands	.....	.....	.....	.....	.....	1,817	.....	.....	.....	.....	1,817
Guiana, British	624	2,726	3,420	3,884	5,512	10,171	29,437	39,488	49,637	108,717	255,421
Dutch	.....	63	544	308	1,339	2,588	1,918	3,385	3,265	5,518	17,928
French	.....	.....	.....	.....	14	45	.....	75	81	420	635
Paraguay	.....	.....	.....	16	.....	35	.....	264	2,046	1,245	3,606
Peru	557	1,273	4,838	5,253	9,663	27,934	107,236	156,232	230,812	263,698	808,241
Uruguay	586	1,990	17,987	11,826	76,608	140,427	224,694	72,735	645,970	903,687	2,057,359
Venezuela	130	10,703	20,439	32,635	71,849	128,966	116,612	67,565	226,953	285,497	963,184
Asia:											
Aden	.....	.....	55	264	1,585	440	2,536	.....	1,847	16,714	23,471
China	590	622	28,326	18,971	41,298	36,952	53,089	48,536	254,784	421,364	905,332
Kwantung (leased territory)*	.....	152	.....	.....	999	.....	547	.....	1,425	3,710	7,014
Chosen (Korea)	.....	240	2,578	2,189	4,330	3,909	927	1,388	11,538	16,966	44,065
British India	874	882	3,555	15,441	119,242	145,820	416,411	133,146	557,396	1,096,377	2,489,820
Straits Settlements	283	1,133	7,174	8,595	63,572	142,271	214,887	352,666	636,101	1,109,200	2,537,194
Other British East Indies	160	337	30	1,883	19,012	6,692	52,466	20,236	18,477	33,169	152,869
Dutch East Indies	916	860	2,677	7,688	201,287	415,742	347,912	476,036	686,873	1,712,524	3,798,685
French East Indies	916	860	2,677	7,688	201,287	415,742	347,912	1,514	7,518	6,594	998,888
Hongkong	997	677	1,057	879	4,189	3,252	6,412	15,289	79,334	41,268	213,922
Japan	15,319	29,975	18,629	12,741	20,045	34,243	83,235	57,441	422,432	491,246	1,198,937
Persia	.....	.....	.....	.....	.....	.....	.....	.....	1,092	8,091	9,183
Russia in Asia	.....	.....	.....	.....	100	12,432	.....	8,806	266,674	17,923	305,935
Siam	207	1,334	92	742	2,236	8,547	16,179	12,444	12,239	18,843	72,853
Turkey in Asia	.....	.....	.....	4,037	.....	.....	.....	1,067	12,734	77,202	95,199
Oceania, British:											
Australia	3,292	58,068	94,321	245,240	1,551,154	783,209	819,755	496,882	751,584	1,498,312	5,677,432
New Zealand	7,078	26,270	35,695	201,379	944,008	689,705	946,804	354,715	1,023,807	2,255,999	6,497,307
Other British	.....	37	432	164	574	5,008	16,124	617	7,118	14,074	44,448
Dutch	36	956	7,278	5,261	8,990	8,102	10,801	.....	.....	.....	42,090
French	.....	.....	396	.....	41	518	5,211	6,073	13,516	13,719	39,579
German	.....	.....	.....	.....	.....	.....	.....	2,854	8,862	5,676	17,392
Philippine Islands	90,759	100,476	141,205	250,832	391,634	345,702	863,727	423,568	1,372,544	2,423,198	6,477,408
Africa:											
Belgian Kongo	.....	.....	.....	.....	17	.....	.....	.....	.....	2,352	2,369
British Africa, West	.....	80	.....	1,149	27,301	10,967	33,470	25,210	122,940	709,696	930,870
South	8,310	17,057	27,090	32,822	291,318	391,211	693,065	372,606	479,934	1,778,167	4,098,529
East	.....	536	642	4,833	9,732	20,162	21,849	165	32,402	119,281	207,654
Canary Islands	.....	270	.....	.....	1,777	.....	.....	.....	4,545	18,326	25,009
Egypt	.....	.....	208	63	532	1,316	.....	.....	25,881	143,772	171,772
French Africa	.....	.....	.....	.....	.....	420	2,399	131	28,821	53,082	84,953
Italian Africa	.....	.....	.....	.....	.....	174	.....	.....	.....	.....	174
Liberia	.....	.....	.....	.....	.....	92	.....	.....	45	2,661	2,798
Madagascar	.....	.....	.....	.....	197	.....	.....	565	.....	.....	762
Kamerun	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,125	8,125
Morocco	.....	.....	.....	.....	.....	.....	.....	.....	225	14,830	15,055
Portuguese Africa	71	.....	.....	946	3,2601	.....	.....	2,698	150	29,732	37,306
										Grand Total	$149,900,637

*Previous to 1918 listed as British, French and Japanese China. †Includes Casings, Inner Tubes and Solid Tires.

1921 Specifications of Stock Engines for

MAKE AND MODEL	Designed for (Cars, Trucks, Tractors)	Number of Cylinders	Bore and Stroke	Piston Displacement (Cu. In.)	Cylinders Cast	Is Cylinder Head Detachable?	Valves Placed	Valve Port Diameter (In.)	Valve Lift (In.)	Type of Cam Follower	Volume of Compression Space (Cu. In.)	Piston Length (In.)	Number of Piston Rings	Is Scraper Ring Used?	Weight of Piston with Wrist Pin and Rings (Lb.)	Weight of Connecting-Rod (Lb.)	Length of Connecting-Rod (C. to C.)	Width of Wrist Pin Bearing (In.)	Diameter of Wrist Pin Bearing (In.)	Width of Connecting-Rod Lower End Bearing (In.)	Diameter of Connecting-Rod Lower End Bearing (In.)	Diameter of Crankshaft	Number of Crankshaft Bearings	LENGTH OF CRANKSHAFT BEARINGS		
																								Front	1st Int.	Rear
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Beaver	C	6	3½x5¼	303.0	B	Yes	H	1¾	5/16	R	.....	4½	4	Yes	2.87	4.25	11	1½	1½	2	2¼	2⅜	3	2¾	2⅜	2¾
Beaver	T,Tr	4	4½x6	425.0	B	Yes	H	2⅜	3/8	R	.....	5⅝	4	Yes	6.50	9.06	12½	2⅞	1½	2¾	2¼	2⅜	3	3½	3½	4½
Beaver	T,Tr	4	4½x6	381.6	B	Yes	H	2⅜	3/8	R	.....	5⅝	4	Yes	6.00	9.06	12½	2⅝	1½	2¾	2¼	2⅜	3	3½	3½	4½
Climax	T,Tr	4	5½x7	665.2	P	Yes	R	2¼	5/16	M	59	7	3	No	12.18	11.62	14	2⅝	1½	3½	2½	2½	3	3½	4½	4½
Climax	T,Tr	4	5 x6½	510.4	P	Yes	R	2¼	5/16	M	49	5¾	3	No	7.12	8.50	13	2 1/16	1 23/64	3	2¼	2½	3	3¾	4	4½
Climax	K T,Tr	4	5 x6½	510.4	P	Yes	R	2¼	5/16	M	49	5¾	3	No	7.12	8.50	13	2 1/16	1 23/64	3	2¼	2¼	3	3¾	4	4½
Continental	J4 T	4	3¾x5	221.0		Yes	R		5/16	M	17	4⅞	4	No	3.62	4.87	11	1¾	1⅛	2	2⅜	2	3	2¼	2¼	2⅝
Continental	N T	4	3¾x5	221.6	B	No	R		9/32	M	15.8	3¾	3	No	3.00	3.62	10½	1½	1 1/32	2⅜	1⅞	2¼	3	3½	2½	3 9/32
Continental	7R C	6	3¼x4½	224.0	B	Yes	R		5/16	M	10.6	4⅛	3	No	2.50	3.00	10½	1⅜	⅞	1⅝	2¼	2¼	4	2⅝	1⅝	3⅛
Continental	C4 T	4	4½x5¼	281.0	B	No	L		9/32	M	25.6	5⅛	3	No	4.25	4.50	10½	1¾	1 1/32	2½	2⅜	2¼	3	2⅝	3	4⅞
Continental	K4 T	4	4½x5¼	281.0	B	Yes	R		5/16	M	22.7	5⅞	4	No	4.06	3.56	11⅛	1⅞	1¼	2⅜	2⅛	2¼	3	2⅝	2¾	2¾
Continental	C2 T	4	4½x5¼	281.0	B	No	R		5/16	M	19.1	5¼	3	No	4.25	4.50	11	1¾	1 1/32	2¼	2	2¼	3	2⅞	3	4 9/32
Continental	9N C	6	3½x5¼	303.0	B	No	R		9/32	M	15.3	4½	3	No	3.18	3.87	10¼	1½	1 1/32	1⅝	2⅜	2⅜	3	2¾	2¼	3 9/32
Continental	L4 T	4	4½x5½	350.0	P	Yes	R		5/16	M	35.4	5⅝	4	No	5.87	8.50	12	2	1⅜	2⅝	2¼	2¼	3	3	3¼	3¼
Continental	E4 T	4	4½x5½	350.0	P	No	L		5/16	M	28.7	5⅝	3	No	5.18	6.81	11	2¼	1⅛	3	2¼	2¼	3	3	3¾	4⅝
Continental	E7 T	4	4½x5½	350.0	P	No	L		5/16	M	28.7	5⅝	3	No	5.18	6.81	11	2¼	1⅛	3	2¼	2¼	3	3	3¾	4⅝
Continental	B2 T	4	4¾x6	425.0	P	Yes	R		1 1/32	R	42.6	6⅛	3	No	7.12	8.50	13¼	2⅛	1⅜	3	2⅜	2½	3	3	4	4
Erd	TF Tr	4	4 x6	301.6	B	Yes	H	1¾	5/16	M	.....	4½	3	No	4.93	5.12	11⅛	1¾	1¼	2⅜	2	2	3	3	2½	4
Erd	TF Tr	4	4½x6	340.4	B	Yes	H	1¾	5/16	M	.....	4½	3	No	5.12	7.87	11½	1¾	1¼	2⅜	2	2	3	3	2½	4
Erd	A Tr	4	4½x6	381.6	B	Yes	H	2	5/16	R	.....	6	3	No	7.00	7.87	12½	2⅛	1½	3¼	2⅜	2½	3	3½	3½	4½
Erd	A Tr	4	4¾x6	425.3	B	Yes	H	2	5/16	R	.....	6	3	No	7.50	7.87	12½	2⅛	1½	3¼	2⅜	2½	3	3½	3½	4½
Falls	V11000 C	4	3½x4¼	130.4	B	Yes	H	1¼	9/32	M	9.19	3½	3	No	2.07	2.00	8⅛	1¾	.74	1⅝	2	.....	3	2⅞	1⅞	3
Falls	T800 C	6	3½x4¼	195.6	B	Yes	H	1¼	9/32	M	9.19	3½	3	No	2.07	2.00	8⅛	1¾	.74	1⅝	2	.....	3	2⅞	.....	.....
G. B. & S.	S C-T	4	3¾x4¼	187.9	B	Yes	R	1⅝	7/32	.....	11.7	3⅜	3	Yes	2.81	1.68	7	1½	⅞	2	1½	1⅝	3	3⅞	2¼	4
G. B. & S.	AA C,T,Tr	4	3¾x5	220.0	B	No	R	1⅝	2 3/64	M	12.7	3¾	3	Yes	3.06	2.25	10¼	1½	1	2⅜	1⅞	2¼	3	3	2½	3
Gray-Beall	A C,T,Tr	4	3½x5	192.4	B	Yes	H	1⅝	5/16	M	14.7	4	3	Yes	2.00	2.81	11	2⅛	1	1⅞	2	•	3	2½	2½	3¼
Hercules	CU-2 T,Tr	4	3¾x5½	226.4	B	Yes	R	1⅝	1 1/32	M	19.2	4⅞	4	Yes	4.20	5.20	11	1⅝	1⅛	2⅜	2	2	5	2¼	1½	3⅝
Hercules	CU-3 T,Tr	4	4 x5⅛	257.6	B	Yes	R	1⅝	1 1/32	M	21.6	4⅞	4	Yes	4.95	5.20	11	1⅝	1⅛	2⅜	2	2	5	2¼	1½	3⅝
Hercules	MU-2 T,Tr	4	4¼x5½	312.0	B	Yes	R	1⅞	1 1/32	M	25.9	5⅛	4	Yes	5.00	5.68	12	1⅞	1¼	2½	2	2	5	2⅝	1¾	4⅜
Hercules	MU-3 T,Tr	4	4½x5½	349.9	B	Yes	R	1⅞	1 1/32	M	28.9	5⅛	4	Yes	5.56	5.68	12	1⅞	1¼	2½	2	2	5	2⅝	1¾	4⅜
Hercules	T-2 T,Tr	4	4¾x6	425.3	P	Yes	R	2⅛	1 1/32	R	35.5	5⅝	4	Yes	7.25	8.00	13¼	2⅛	1⅜	3	2⅜	2⅜	5	2¼	2¼	4
Hercules	T-3 T,Tr	4	5 x6	471.2	P	Yes	R	2⅛	1 1/32	R	39.4	5⅝	4	Yes	8.12	8.00	13¼	2⅛	1⅜	3	2⅜	2⅜	5	2¼	2¼	4
Herschell-Spillman	7000 C,T,Tr	4	3½x5	192.4	B	Yes	R	1⅞	5/16	M	14.3	3⅜	3	No	2.00	3.27	11	1⅞	⅞	2	2	2	4	.....	4	
Herschell-Spillman	11000 C	6	3½x5	249.0	B	Yes	R	1⅞	5/16	M	12.4	3½	3	No	1.87	3.25	11	1⅜	⅞	2	2	2⅛	3	3	2⅝	4
Hinkley	HAA300 T,Tr	4	3¾x5¼	231.9	B	Yes	R	1¾	5/16	R	19.8	4¾	3	No	4.20	7.12	11½	1¾	1⅛	2¼	2⅛	2¼	3	2¼	3	3
Hinkley	HAA400 T,Tr	4	4 x5¼	263.9	B	Yes	R	1¾	5/16	R	22.5	4½	3	No	4.37	7.12	11½	1¾	1⅛	2¼	2⅛	2¼	3	2¼	3	3
Hinkley	HA500 T,Tr	4	4½x5½	312.0	B	Yes	R	2	5/16	R	26.6	5¼	3	No	4.50	8.12	12	1⅞	1¼	2½	2¼	2⅜	3	2½	3½	3½
Hinkley	HA200 T,Tr	4	4½x5½	349.9	B	Yes	R	2	5/16	R	29.8	5½	3	No	6.50	8.12	12	1⅞	1¼	2½	2¼	2⅜	3	2½	3½	3½
Hinkley	HA1600 T,Tr	4	4½x5½	349.9	B	Yes	I	2	5/16	R	28.1	5½	3	No	6.50	8.12	12	1⅞	1¼	2½	2¼	2⅜	3	2½	3½	3½
Kessler	K C	4	3¾x3¾	165.0	B	Yes	I	1⅞	5/16	.....	16.0	3	3	Yes	1.37	1.25	6¾	2⅝	¾	2¼	1⅝	2	5	1½	1½	2½
LeRoi	20 C,T,Tr	4	3½x4½	138.1	B	Yes	R	1½	5/16	M	10.2	3½	3	No	1.75	2.25	8	1⅞	¾	2	1¾	1¾	2	2¾	.....	2¾
Lycoming	K C,T	4	3½x5	192.4	B	Yes	R	1½	1 9/64	M	14.3	4	3	No	2.12	2.50	9½	1⅜	⅞	2⅛	2	2⅛	2	3⅜	.....	3⅜
Minerva	A20 T,Tr	4	4½x6	381.6	P	Yes	R	2¼	3/8	M	31.7	6	3	No	6.43	8.18	13¼	2¼	1¼	3	2⅜	2½	3	3	4	4
Pittsburg	93 T	4	3½x4½	138.0	B	Yes	R	1½	5/16	R	11.7	4½	3	No	2.12	2.68	11	1½	9 5/64	1 57/64	1⅜	1⅜	3	3	2	2⅝
Pittsburg	92 C	8	3¼x5	331.8	B	No		1⅞	5/16	R	11.7	3½	3	No	2.12	3.00	11	1½	⅞	1 13/32	1⅞	2	3	3	3	3¼
Red Wing	A T	4	3½x4½	173.0	P	No	L	1⅝	.300	M	61.0	4⅛	3	No	3.18	2.62	8½	1	1.10	2⅛	1½	1½	3	3	2¾	3
Red Wing	F Tr	4	4⅛x5	259.0	B	Yes	L	1¾	.300	M	88.0	4¾	4	Yes	4.75	4.12	10⅜	1¼	1.10	2¼	2	2	3	3½	2¼	3
Red Wing	B Tr	4	4½x5	318.0	B	Yes	L	1⅝	.300	M	113.0	4¾	4	Yes	5.31	4.12	10⅜	1 13/32	1.10	2¼	2	2	3	3½	2¼	4⅛
Reliable	OO Tr	2	6 x6	178.0	S	Yes	H	2⅛	5/16	R	53	7	3	No	19.50	.....	12	.....	.....	2⅜	2⅜	2⅜	2	5½	.....	5½
Reliable	UR Tr	2	6 x7	198.0	B	Yes	H	2⅛	7/16	R	68	7	3	No	19.50	15.00	18	3½	1¾	3	3	3	2	5	.....	5
Rutenber	25 C	6	3½x5	230.0	B	Yes	L	1⅝	5/16	M	.....	3½	4	No	.....	.....	9½	1½	¾	1⅞	2	2	3	2¾	2¾	3½
Supreme	S4 C,T	4	3⅜x5	179.0	B	Yes	R	1⅝	5/16	M	.....	4	3	No	2.12	2.25	10	1⅝	⅞	2	2	2	3	2⅞	1¾	3½
Supreme	5K C	6	3½x5	249.0	B	Yes	R	1⅝	5/16	M	.....	4½	3	No	2.12	2 25	10	1⅝	⅞	1⅝	2	2¼	3	2 1/32	2⅝	2⅝
Stearns	FU T,Tr	4	4 x6	.....	B	Yes	H	2	3/8	R	24.8	5¾	3	Yes	5.75	9.00	12½	2⅛	1½	3¼	2½	2½	3	3¼	4	4
Stearns	GU T,Tr	4	4½x6	340.0	B	Yes	H	2	3/8	R	28.0	5¾	4	Yes	5.87	9.00	12½	.....	1½	3¼	2½	2½	3	3¼	4	4
Stearns	HU T,Tr	4	4½x6	381.0	B	Yes	H	2	3/8	R	31.4	5¾	4	Yes	6.50	9.00	12½	2⅛	1½	3¼	2½	2½	3	3¼	4	4
Stearns	AU T,Tr	4	4¾x6½	462.0	B	Yes	H	2¼	5/16	R	38.0	6	4	Yes	7.31	12.00	13¼	2¼	1⅝	3½	2¾	2¾	3	3½	4½	4½
Stearns	BU T,Tr	4	5 x6½	510.0	B	Yes	H	2¼	5/16	R	42.1	6	4	Yes	7.43	12.00	13¼	2¼	1⅝	3½	2¾	2¾	3	3½	4½	4½
Twin City	TW T,Tr	4	4¼x6	340.5	B	Yes	H	1½	5/16	M	31.8	5 3/32	4	Yes	5.00	7.00	12	2	1¼	2⅞	2⅜	•	3	3	2⅝	4
Twin City	AE Tr	4	5½x6¾	641.5	B	Yes	H	1¾	7/16	M	64.0	6¾	5	Yes	9.75	15.75	14	3½	1⅝	3⅝	3	•	3	3 3/16	4	5¾
Waukesha	BUX T,Tr	4	3¾x5¼	232.0	B	Yes	R	1¾	5/16	M	.....	3⅞	4	Yes	2.87	5.62	10⅝	1⅝	1	2¼	1⅞	2	3	2½	2½	2⅝
Waukesha	FU T,Tr	4	4 x5¼	289.0	P	Yes	R	2	1 1/32	R	10.9	5⅜	3	No	5.31	7.25	12½	2⅜	1¼	2½	2⅜	2½	3	2½	3¼	3¼
Waukesha	CU T,Tr	4	4⅜x5¾	346.0	P	Yes	R	2	1 1/32	R	13.1	5⅜	3	No	5.31	7.25	12¼	2⅝	1¼	2½	2⅜	2½	3	2½	3½	3½
Waukesha	DU T,Tr	4	4½x6¼	398.0	P	Yes	R	2⅛	1 1/32	R	14.6	5⅞	3	No	6.50	7.62	13¼	2⅝	1⅜	2¾	2⅜	2½	3	2¾	3½	3½
Waukesha	EU T,Tr	4	5 x6¼	491.0	P	Yes	R	2⅛	1 1/32	R	18.0	6½	3	No	7.00	8.75	13¼	3⅛	1⅝	3¼	2⅜	2½	3	3¼	4	4
Weidely	MB	4	3½x5½	227.1	B	Yes	H	1⅞	5/16	M	16.0	4⅜	3	Yes	2.68	4.18	12½	1⅝	1	2¼	2	2⅛	3	2½	2½	4
Weidely	MAU	4	3¾x5½	242.9	B	Yes	H	1⅞	.3053	M	20.3	4½	4	Yes	3.34	4.31	11	1⅝	1	2¼	2	2⅛	3	2 1/32	2 1/32	4 1/32
Weidely	MAT	4	3¾x5½	242.9	B	Yes	H	1⅞	.3053	M	20.3	4½	4	Yes	3.34	4.31	11	1⅝	1	2¼	2	2⅛	3	2 1/32	2 1/32	4 1/32
Weidely	MAT	4	4 x5½	276.5	B	Yes	H	1⅞	.3053	M	21.8	4½	4	Yes	4.11	4.31	11	1⅝	1	2¼	2	2⅛	3	2 1/32	2 1/32	4 1/32
Weidely	MAU Tr	4	4 x5½	276.5	B	Yes	H	1⅞	.3053	M	21.8	4½	4	Yes	4.11	4.31	11	1⅝	1	2¼	2	2⅛	3	2 1/32	2 1/32	4 1/32
Weidely	M	4	4 x5½	.....	B	Yes	H	1⅞	.3053	M	21.8	4½	4	Yes	4.11	4.31	11	1⅝	1	2¼	2	2⅛	3	2⅝	2 1/32	4 1/32
Weidely	C	12	2⅞x5	389.5	B	Yes	H	1⅝	.258	M	8.9	3½	3	Yes	1.60	.....	10	1⅜	5/8	1⅝	2	2⅛	3	2½	2¾	4
Wisconsin	CAU C,T,Tr	4	3⅜x5	221.0	B	No	L	1½	5/16	M	17.4	5 3/32	3	No	4.18	4.31	10⅜	1¾	1⅜	2¼	1¾	1¾	3	2¾	2⅝	4
Wisconsin	EAU C,T,Tr	4	4 x5	251.0	B	No	L	1½	5/16	M	19.9	4 25/32	3	No	4.31	4.31	10⅜	1¾	1⅝	2¼	1¾	1¾	3	2¾	2⅝	4
Wisconsin	TAU C,T,Tr	4	4 x6	301.0	B	Yes	R	2 1/32	5/16 in.-3/8 Ex.	M	24.9	5⅜	3	No	4.18	5.75	12	2	1⅜	3	2	2	4	2½	2½	3½
Wisconsin	UAU C,T,Tr	4	4¼x6	340.0	B	Yes	R	2 1/32	5/16 in.-3/8 Ex.	M	28.1	5⅛	3	No	4.87	5.75	12	2	1⅜	3	2	2	4	2½	2½	3½
Wisconsin	VAU C,T,Tr	4	4½x6	382.0	B	Yes	R	2 1/32	5/16 in.-3/8 Ex.	M	34.5	4⅝	3	No	4.93	5.75	12	2	1⅜	3	2	2	4	2½	2½	3½
Wisconsin	RAU C,T,Tr	4	4¾x6	425.0	P	Yes	R	2⅛	1 1/32 in.-3/8 Ex.	R	38.4	5 3/32	3	No	6.12	7.18	12½	2⅛	1⅜	3	2¼	2¼	3	3	3¾	4
Wisconsin	RBU T,Tr	4	5 x6	471.0	P	Yes	R	2⅛	1 1/32 in.-3/8 Ex.	R	42.4	6⅛	3	No	6.50	7.25	12½	2⅛	1⅜	3	2¼	••	3	3	3¾	4
Wisconsin	M T,Tr	4	5¾x7	730.0	P	No	O	2 13/32	3/8	R	60.6	6½	4	No	10.12	9.37	14	3⅜	1⅞	3½	2⅜	2⅜	4	4	4	6
Wisconsin	P T,Tr	6	5¾x7	1095.0	P	No	O	2 13/32	3/8	R	60.6	6½	4	No	10.12	9.37	14	3⅜	2⅜	3½	2⅜	2⅜	4	4	4	6

STOCK ENGINE ABBREVIATIONS—Explanation of abbreviations; Numbers in brackets indicate the column to which reference is made; (1) **C**—Car; **T**—Truck; **Tr**—Tractor. (5) **B**—Block; **P**—Pairs; **S**—Singly; **T**—Threes. (7) **H**—Head; **R**—Right; **I**—Left; **Op**—Opposite; **Sl**—Sleeve. (10) **R**—Roller; **M**—Mushroom; **R-A**—Rocker Arm. (29) **I**—Integral; **S**—Separate; **Opt**—Optional. (30) **C-P**—Centrifugal Pump; **T-S**—Thermo-Syphon; **G-P**—Gear Pump; **Opt**—Optional. (31) **S-P**—Splash-Pressure; **C-S**—Circulating-Splash; **Pr**—Pressure; **C-P**—Circulating Pressure. (32-35) **A**—Aluminum; **I**—Iron; **S-S**—Semi-Steel; **P-S**—Pressed Steel; **B**—Bronze. (46) **G**—Gear; **C**—Chain. (47) **S**—Silent. (48) **A**—Adjustable.

Passenger Cars, Trucks and Tractors

Is Cylinder Offset?	If Offset—How Much?	Intake Manifold (Separate or Integral)	Water Circulated By	Lubrication System	Material of Crankcase	Material of Lower Half of Crankcase	Material of Cylinders	Material of Pistons	R.P.M. at Which Maximum H.P. is Developed	R.P.M. at Which Maximum Torque is Developed	Is Governor Fitted?	If So—What Type?	Governed Speed	Maximum Brake H.P. of Average Product	Weight of Engine Without Ignition or Carbureter (Lb.)	Overall Width of Engine (In.)	Overall Height of Engine (In.)	Overall Length of Engine (In.)	Type of Front End Drive	If Chain—What Type?	Adjustable or Non-adjustable	Points of Engine Support	Adapted for Heavy Fuel	Is Bell Housing Provided?	If So—What Number and Type?	MAKE AND MODEL
27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	
No.	....	I.	C-P.	Pr.	A.	A.	I.	I.	2400	1000	No.	....	....	67	675	24½	34⅛	42½	G.	....	....	3	No.	Yes	3-S.A.E.	Beaver CL
Yes	½	I.	C-P.	S-P.	I.	I.	I.	I.	1250	750	No.	....	....	47	1025	19½	39⅛	41¾	G.	....	....	Opt.	Yes	Yes	3-S.A.E.	Beaver JR
Yes	½	I.	C-P.	S-P.	I.	I.	I.	I.	1200	700	No.	....	....	40	1000	19½	39⅛	41¾	G.	....	....	Opt.	Yes	Yes	2-S.A.E.	Beaver JA
No.	....	S.	C-P.	Pr.	I.	I.	S-S.	I.	800	500	Yes.	Cent.	....	44	1530	26	43⅞	55⅛	G.	....	....	3	Yes.	Yes	1-S.A.E.	Climax TU
No.	....	S.	C-P.	Pr.	I.	I.	S-S.	I.	850	500	Yes.	Cent.	....	35	1100	24	39¾	44⅝	G.	....	....	4	Yes.	Yes	2-S.A.E.	Climax KU
No.	....	S.	C-P.	Pr.	I.	I.	S-S.	I.	850	500	Yes.	Cent.	....	35	1050	24	39¾	44⅝	G.	....	....	4	Yes.	No.	....	Climax K
No.	....	I.	C-P.	Pr.	A.	A.	I.	I.	1500	900	No.	....	....	30	590	24½	31⅛	34 11/32	G.	....	....	3	No.	Yes	3-S.A.E.	Continental J4
No.	....	....	Opt.	S-P.	A.	P-S.	I.	I.	2200	1200	No.	....	....	38	475	24½	30⅜	34⅛	G.	....	....	3	No.	....	....	Continental N
No.	....	I.	C-P.	S-P.	A.	P-S.	I.	I.	2600	1400	No.	....	....	55	580	21⅝	31½	40⅛	G.	....	....	3	No.	Yes	3-S.A.E.	Continental 7R
No.	....	S.	C-P.	S-P.	A.	A.	I.	I.	1600	850	No.	....	....	33	560	26¾	32⅞	37 9/32	G.	....	....	3	No.	Yes	2-S.A.E.	Continental C4
No.	....	I.	C-P.	S-P.	A.	A.	I.	I.	1600	900	No.	....	....	38	680	24½	36 19/32	37 11/32	G.	....	....	3	No.	Yes	2-S.A.E.	Continental K4
No.	....	I.	C-P.	S-P.	A.	P-S.	I.	I.	1400	900	No.	....	....	35	580	26¾	32⅞	37 21/32	G.	....	....	3	No.	Yes	2-S.A.E.	Continental K4
No.	....	S.	C-P.	S-P.	A.	P-S.	I.	I.	2000	900	No.	....	....	55	600	24½	29 23/32	41 25/32	G.	....	....	3	No.	Yes	Own Spec.	Continental C2
No.	....	I.	C-P.	S-P.	A.	A.	I.	I.	1400	900	No.	....	....	48	807	24½	37⅜	40 31/32	G.	....	....	3	No.	Yes	3-S.A.E.	Continental 9N
No.	....	S.	C-P.	S-P.	A.	A.	I.	I.	1400	900	No.	....	....	40	650	26¾	33⅜	41 23/32	G.	....	....	3	No.	Yes	2-S.A.E.	Continental L4
No.	....	S.	C-P.	S-P.	A.	A.	I.	I.	1400	900	No.	....	....	40	650	26¾	33⅜	41 23/32	G.	....	....	3	No.	Yes	2-S.A.E.	Continental E4
No.	....	S.	C-P.	S-P.	A.	A.	I.	I.	1300	900	Yes.	....	1000	55	1016	24⅝	39 21/32	45⅞	G.	....	....	3	No.	Yes	2-S.A.E.	Continental E7
No.	....	I.	C-P.	Pr.	I.	I.	I.	I.	1200	900	Opt.	Opt.	1000	32.5	800	23½	34⅝	40⅝	G.	....	....	Opt.	Yes	Yes	Opt.	Continental B2
No.	....	S.	C-P.	Pr.	I.	I.	I.	I.	1200	900	Opt.	Opt.	1000	38	850	23½	34⅝	40⅝	G.	....	....	Opt.	Yes	Yes	Opt.	Erd TF
Yes	½	I.	C-P.	Pr.	I.	I.	I.	I.	1400	800	Opt.	Opt.	1000	44	1100	24	43⅛	46⅝	G.	....	....	Opt.	Yes	Yes	Opt.	Erd TF
Yes	½	I.	C-P.	Pr.	I.	I.	I.	I.	....	....	Opt.	Opt.	1000	46	1150	24	43⅛	46⅝	G.	....	....	Opt.	Yes	Yes	Opt.	Erd A
No.	....	I.	T-S.	Pr.	I.	I.	I.	I.	....	....	No.	....	....	....	360	25¾	28¾	32⅝	G.	....	....	3	No.	Yes	4-S.A.E.	Erd A
No.	....	I.	T-S.	Pr.	I.	I.	I.	I.	2000	700	No.	....	....	37	475	25¾	28¾	38⅝	G.	....	....	3	No.	Yes	4-S.A.E.	Falls V11000
Yes	⅝	S.	T-S.	C-S.	I.	P-S.	S-S.	S-S.	1600	800	Yes.	....	1000	30	450	23½	25	34	G.	....	....	3	No.	Yes	4-S.A.E.	Falls T800
No.	....	S.	C-P.	Pr.	A.	A.	S-S.	S-S.	1700	800	Yes.	Cent.	1400	35	425	25¾	31	34⅛	G.	....	....	4	No.	Yes	5-S.A.E.	G. B. & S. S
No.	....	I.	T-S.	S-P.	I.	P-S.	I.	I.	2200	1200	Opt.	....	....	35	460	25¾	33½	34⅛	G.	....	....	3	No.	Yes	3-S.A.E.	G. B. & S. AA
																						3	Yes.	Yes	3-S.A.E.	Gray-Beall A
No.	....	S.	C-P.	Pr.	I.	I.	I.	I.	2000	1000	Opt.	Opt.	Opt.	35	750	25¾	35⅝	38⅝	G.	....	....	3	Yes.	Yes	3-S.A.E.	Hercules CU-2
No.	....	S.	C-P.	Pr.	I.	I.	I.	I.	1800	1000	Opt.	Opt.	Opt.	39	750	25¾	35⅝	38⅝	G.	....	....	3	Yes.	Yes	3-S.A.E.	Hercules CU-3
No.	....	S.	C-P.	Pr.	I.	I.	I.	I.	1700	800	Opt.	Opt.	Opt.	46	850	25¾	41	43⅝	G.	....	....	3	Yes.	Yes	2-S.A.E.	Hercules MU-2
No.	....	S.	C-P.	Pr.	I.	I.	I.	I.	1600	750	Opt.	Opt.	Opt.	50	850	25¾	41	43⅝	G.	....	....	3	Yes.	Yes	2-S.A.E.	Hercules MU-3
No.	....	S.	C-P.	Pr.	A.	A.	I.	I.	1500	700	Opt.	Opt.	Opt.	....	1000	28¾	41⅜	44⅝	G.	....	....	3	Yes.	Yes	1-S.A.E.	Hercules T-2
No.	....	S.	C-P.	Pr.	A.	A.	I.	I.	1500	700	Opt.	Opt.	Opt.	70	1000	28¾	41⅜	44⅝	G.	....	....	3	Yes.	Yes	1-S.A.E.	Hercules T-3
No.	....	S.	T-S.	S-P.	S-S.	P-S.	S-S.	I.	1800	900	No.	....	....	33	441	25½	31	35¾	G.	....	....	3	Yes.	Yes	3-5 S.A.E.	Herschell-Spillman 7000
No.	....	S.	C-P.	S-P.	S-S.	P-S.	S-S.	I.	2300	900	No.	....	....	45	560	25½	30⅞	44	....	....	....	....	No.	Yes	3-5 S.A.E.	Herschell-Spillman 11000
No.	....	S.	C-P.	Pr.	S-S.	P-S.	I.	I.	1600	800	Yes.	Own.	Opt.	37	732	25¾	36	37¼	G.	....	....	3	No.	Yes	3-S.A.E.	Hinkley HAA300
No.	....	S.	C-P.	Pr.	S-S.	P-S.	I.	I.	1650	800	Yes.	Own.	Opt.	42	750	25¾	36	37¼	G.	....	....	3	No.	Yes	3-S.A.E.	Hinkley HAA400
No.	....	S.	C-P.	Pr.	S-S.	A.	I.	I.	1450	700	Yes.	Own.	Opt.	45	887	26½	40	43⅞	G.	....	....	3	No.	Yes	2-S.A.E.	Hinkley HA500
No.	....	S.	C-P.	Pr.	S-S.	A.	I.	I.	1500	700	Yes.	Own.	Opt.	50	895	26½	40	43⅞	G.	....	....	3	No.	Yes	2-S.A.E.	Hinkley HA200
No.	....	S.	C-P.	Pr.	S-S.	A.	I.	I.	1600	700	Yes.	Own.	Opt.	55	1040	26½	45½	43⅞	G.	....	....	3	No.	Yes	2-S.A.E.	Hinkley HA1600
No.	....	S.	T-S.	S-P.	I.	A.	I.	A.	3300	2400	No.	....	....	70	385	....	....	....	G.	....	....	4	No.	Yes	3-S.A.E.	Kessler K
No.	....	S.	T-S.	C-S.	I.	I.	I.	S-S.	2200	1200	Opt.	....	Opt.	25	325	16	25	32	G.	....	....	3	No.	Opt.	3-4-S.A.E.	LeRoi 20
No.	....	I.	T-S.	C-S.	I.	P-S.	I.	I.	2100	950	No.	....	....	35	470	21⅝	26⅞	38⅛	G.	....	....	3	No.	Yes	3-S.A.E.	Lycoming K
No.	....	S.	C-P.	Pr.	S-S.	I.	S-S.	I.	1000	800	Yes.	Cent.	900	40	900	24¼	37	46¼	G.	....	....	3	Yes.	Yes	Opt-SAE.	Minerva A20
No.	....	S.	T-S.	S-P.	I.	P-S.	I.	I.	1800	1000	No.	....	....	20	395	21	28⅝	45⅜	G.	....	....	3	....	Yes	Special	Pittsburg 93
No.	....	S.	C-P.	S-P.	A.	A.	I.	I.	2400	1100	No.	....	....	70	705	24⅜	23⅞	65⅝	G.	....	....	3	No.	Yes	3-S.A.E.	Pittsburg 92
Yes	⅝	S.	C-P.	C-S.	I.	I.	I.	I.	....	....	Yes.	Cent.	1100	17	480	19	30⅝	31½	G.	....	....	4	No.	No.	....	Red Wing A
No.	....	I.	C-P.	C-S.	I.	I.	I.	I.	....	....	Yes.	Cent.	950	22	560	20⅜	28⅛	36⅞	G.	....	....	4	No.	No.	....	Red Wing F
Yes	⅛	I.	C-P.	C-S.	I.	I.	I.	I.	....	....	Yes.	Cent.	900	26	600	20⅞	28⅜	36⅞	G.	....	....	4	No.	No.	....	Red Wing B
No.	....	I.	C-P.	Pr.	....	....	S-S.	S-S.	....	....	Yes.	F-B.	600	24	800	40⅜	28	55	G.	....	....	4	Yes.	No.	....	Reliable OO
No.	....	I.	C-P.	Pr.	S-S.	....	S-S.	S-S.	650	600	Yes.	F-B.	600	24	1150	47½	26	47	G.	....	....	4	Yes.	No.	....	Reliable UR
No.	....	I.	C-P.	S-P.	I.	P-S.	I.	I.	2400	....	No.	....	....	45	545	25¼	27	40⅜	G.	....	....	3	No.	Yes.	3-S.A.E.	Rutenber 25
Yes	⅝	I.	T-S.	Pr.	I.	P-S.	I.	I.	2150	1400	No.	....	....	40	430	24½	30	32 11/32	G.	....	....	3	No.	Yes	3-5-S.A.E.	Supreme S4
Yes	⅝	S.	C-P.	Pr.	I.	P-S.	I.	I.	2500	1000	No.	....	....	58	560	24½	30	37 9/32	G.	....	....	3	No.	Yes	3-S.A.E.	Supreme 5K
Yes	½	O.	C-P.	Pr.	I.	A.	I.	I.	1650	1070	Yes.	Cent.	950	....	....	23	38⅝	41	G.	....	....	Opt.	Yes.	Yes.	2-3-S.A.E.	Stearns FU
Yes	½	O.	C-P.	Pr.	A.	A.	I.	I.	1650	1070	Yes.	Cent.	950	....	....	23	38⅝	41	G.	....	....	Opt.	Yes.	Yes.	1-2-3-SAE	Stearns GU
Yes	½	O.	C-P.	....	A.	A.	I.	I.	1650	1070	Yes.	Cent.	950	....	....	23	38⅝	41	G.	....	....	Opt.	Yes.	Yes.	1-2-3-SAE	Stearns HU
Yes	½	O.	C-P.	Pr.	I.	A.	I.	I.	1425	800	Yes.	Cent.	850	....	....	23	42¾	44¾	G.	....	....	Opt.	Yes.	Yes.	1-2-S.A.E.	Stearns AU
Yes	½	O.	C-P.	Pr.	I.	A.	I.	I.	1425	800	Yes.	Cent.	850	....	....	23	42¾	44¾	G.	....	....	Opt.	Yes.	Yes.	1-2-S.A.E.	Stearns BU
No.	....	S.	C-P.	Pr.	I.	P-S.	I.	I.	....	....	Yes.	Cent.	1000	40†	950	25⅜	39½	44⅝	G.	....	....	Opt.	Yes.	Yes.	2-S.A.E.	Twin City TW
No.	....	S.	C-P.	Pr.	I.	A.	I.	I.	....	....	Yes.	Cent.	900	58†	1750	29	50	55¾	G.	....	....	4	Yes.	No.	....	Twin City AE
No.	....	S.	C-P.	C-S.	A.	I.	I.	I.	1800	900	Yes.	Own.	1000	26	615	20⅞	29	36¾	G.	....	....	3	Yes.	Yes.	3-S.A.E.	Waukesha BUX
Yes	¼	S.	C-P.	Pr.	A.	I.	I.	I.	1500	1000	Yes.	Own.	1000	32	825	30½	38¾	55½	G.	....	....	3	Yes.	Yes.	2-S.A.E.	Waukesha FU
Yes	¼	S.	C-P.	Pr.	A.	I.	I.	I.	1500	630	Yes.	Own.	1000	32	840	30½	38¾	55½	G.	....	....	3	Yes.	Yes.	2-S.A.E.	Waukesha CU
Yes	¼	S.	C-P.	Pr.	A.	I.	I.	I.	1500	650	Yes.	Own.	1000	40	910	30½	40½	58	G.	....	....	3	Yes.	Yes.	1-2-S.A.E.	Waukesha DU
Yes	½	S.	C-P.	Pr.	A.	I.	I.	I.	1400	650	Yes.	Own.	1000	50	980	30½	40½	62	G.	....	....	3	Yes.	Yes.	1-2-S.A.E.	Waukesha EU
No.	....	I.	C-P.	Pr.	A.	A.	I.	I.	2400	1200	No.	....	....	55	700	25¾	34⅜	38	G.	....	....	4	No.	Yes.	3-S.A.E.	Weidely MB
No.	....	I.	C-P.	Pr.	I.	I.	I.	I.	2000	1000	Opt.	....	....	40	700	25¾	32⅝	40⅝	G.	....	....	Opt.	No.	Yes.	3-S.A.E.	Weidely MAU
No.	....	I.	C-P.	Pr.	I.	I.	I.	I.	2000	1000	No.	....	....	40	700	25¾	32⅝	40⅝	G.	....	....	Opt.	....	Yes.	3-S.A.E.	Weidely MAT
No.	....	I.	C-P.	Pr.	I.	I.	I.	I.	2000	1000	No.	....	....	45	700	25¾	32⅝	40⅝	G.	....	....	Opt.	....	Yes.	3-S.A.E.	Weidely MAT
No.	....	I.	C-P.	Pr.	I.	I.	I.	I.	2000	1000	Opt.	....	....	45	700	25¾	32⅝	40⅝	G.	....	....	Opt.	....	Yes.	3-S.A.E.	Weidely MAU
No.	....	I.	C-P.	Pr.	I.	I.	I.	I.	....	....	Yes.	....	....	45	700	....	....	....	G.	....	....	4	....	No.	....	Weidely M
No.	....	S.	C-P.	Pr.	A.	A.	I.	I.	2000	....	No.	....	....	75	750	24½	33⅜	60	G.	....	....	3	....	Yes.	3-S.A.E.	Weidely C
No.	....	S.	C-P.	Pr.	A.	A.	I.	I.	1600	1000	Opt.	....	1000	26	450	21	31	35⅝	G.	....	....	3	No.	Yes.	3-S.A.E.	Wisconsin CAU
No.	....	S.	C-P.	Pr.	A.	A.	I.	I.	1600	1000	Opt.	....	1000	30	460	21	31	35⅝	G.	....	....	3	No.	Yes	....	Wisconsin EAU
No.	....	S.	C-P.	Pr.	A.	A.	I.	I.	1500	1000	Opt.	....	1000	45	650	21⅞	30⅛	44⅜	G.	....	....	3	Yes.	Yes.	3-S.A.E.	Wisconsin TAU
No.	....	I.	C-P.	Pr.	A.	A.	I.	I.	1600	1000	Opt.	....	1000	55	660	21⅞	30⅛	44⅜	G.	....	....	3	Yes.	Yes.	3-S.A.E.	Wisconsin UAU
No.	....	I.	C-P.	Pr.	A.	A.	I.	I.	1600	1000	Opt.	....	1000	55	680	21⅞	30⅛	44⅜	G.	....	....	3	Yes.	Yes.	3-S.A.E.	Wisconsin VAU
No.	....	I.	C-P.	Pr.	A.	A.	I.	I.	1600	1000	Opt.	....	1000	60	790	24	31¾	46	G.	....	....	3	Yes.	Yes.	3-S.A.E.	Wisconsin RAU
No.	....	I.	C-P.	Pr.	A.	A.	I.	I.	1600	950	Opt.	....	950	65	800	24	31¾	46	G.	....	....	3	Yes.	Yes.	3-S.A.E.	Wisconsin RBU
No.	....	S.	C-P.	Pr.	A.	A.	I.	I.	1350	950	Opt.	....	800	90	900	23½	37¼	48⅛	G.	....	....	4	No.	No.	....	Wisconsin M
No.	....	S.	C-P.	Pr.	B.	A.	I.	I.	1350	850	Opt.	....	800	125	1275	23½	37¼	64¼	G.	....	....	4	No.	No.	....	Wisconsin P

N—Non-Adjustable. Twin city model TW crankshaft stepped; Front, 2¼; center, 2 11/16; rear, 2⅜. Twin City model AE crankshaft stepped; front, 2⅞; center, 3; rear, 3⅛. Wisconsin model RBU crankshaft stepped; front, 2¼; center, 2 5/16; rear, 2⅜. Gray-Beall crankshaft stepped; front, 2; center, 2 1/16; rear, 2⅛. Twin City horsepower rating based on gasoline as fuel. Develops 35 on model TW and 50 on model AE when using kerosene.

1921 Road Expenditures

MORE than $600,000,000 is available for road and bridge expenditures in the United States during the year 1921. The exact figure as given out by the U. S. Department of Agriculture is $622,000,000, all of which is authorized to be spent during the coming year.

As noted in the registration article, about $98,000,000 were collected as automobile fees by the various states. Adding this to the above sum gives a total of $720,000,000 which will probably be spent upon roads in this country immediately, the money received from fees being used chiefly for maintenance and repair.

Texas will spend the greatest sum on its roads, the total figure for this state being $60,000,000. New York follows with $55,000,000, and Iowa is next with $37,000,000. The ten states that will spend the most are in order:

Texas	$60,000,000
New York	55,000,000
Iowa	37,000,000
Ohio	35,000,000
Pennsylvania	30,000,000
California	26,000,000
Illinois	20,000,000
Kansas	20,000,000
Michigan	20,000,000
Minnesota	20,000,000

The fact that Texas leads this list is of interest in considering that state as a market for motor vehicles. Since it is one of the largest states as to population a large road expenditure might be expected. Nevertheless it is interesting to note that it does not yet have as many cars per capita as do several other large population states. The number of persons per car, for instance, in some of the big states is as follows:

California	6.04
Michigan	8.91
Ohio	9.34
Texas	9.79

Each of these big states which have more cars per capita than Texas, are more restricted in area. Michigan and Ohio, particularly are big manufacturing centers. In other words, Texas would seem to have certain natural advantages as an automobile market in the way of area that are not possessed by some of the other states which now lead it in cars per capita. Consequently, the expenditure of this large sum on new roads, would indicate that within the next few years the active market for cars in that state should increase materially.

The table shows that every state has made some appropriation for roads, the smallest appropriation being by the smallest state in the union, Rhode Island. The group of agricultural states has available the largest total, chiefly because it includes two of the three leaders, Texas and Iowa. The agricultural group has appropriated $201,000,000.

The manufacturing group includes Massachusetts, New York, Ohio, Pennsylvania, Michigan, Indiana, Delaware, Connecticut, Rhode Island, New Jersey and Wisconsin. The agricultural group includes Arkansas, North Dakota, South Dakota, Kansas, Minnesota, Nebraska, Oregon, Oklahoma, Texas, Washington, Iowa. The mining group includes Wyoming, Nevada, Utah, New Mexico, Montana, Colorado, Arizona, and Idaho. The Southern group includes Florida, Georgia, Virginia, North Carolina, South Carolina, West Virginia, Kentucky, Tennessee,

Specifications

MAKE AND MODEL	Designed for: (Cars or Trucks)	Load Capacity (Lb.) (Truck Axles Only)	Type	Final Drive	GEAR RATIOS						Diameter of Axle Shafts	Range of Spring Centers		Provision for Torque Taken on
					Standard			Optional				Maximum	Minimum	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Eaton 602	T	4700	S-F	W				6.50	7.25	7.75	2 11/32	39 1/2	34 1/2	Sp
Eaton 603	T	7480	S-F	W				5.80	6.50	7.80	2 3/8	39 1/4	34 1/2	Sp
Eaton 604	T	9300	S-F	W				7.75	8.33	9.66	2 3/4	39 3/4	36	Sp
Eaton 605	T	11150	S-F	W				7.75	8.50	9.33	2 5/8	41	36	Sp
Eaton 607	T	12900	S-F	W				8.75	9.33	10.25	3 5/8	44 1/4	39 1/4	Sp
Eaton 612	T	19100	S-F	W				9.50	11.66		3 7/8	47 1/4	43 1/4	Sp
Eaton 1000	T	4200	S-F	B	6.14			5.12	5.62		2	40 1/2	37 1/2	Sp
Eaton 40	C		S-F	B	4.08			3.77	4.45	4.90	1 5/8	41 1/2	37	Sp
Eaton 50	C		S-F	B	4.08			3.77	4.45	4.90	1 3/4	40	37	Sp
Eaton 2550	C		S-F	Sp-B				3.75	4.25	4.50	1 7/8	42 3/4	37	Sp
Eaton 2050	C		S-F	Sp-B				3.75	4.12	4.25	1 3/8	43 1/4	36	Sp
Eaton 3070	C		S-F	Sp-B				3.50	3.75	3.87	1 3/4	42	36	Sp
Clark AW	T	3600	FF	I-G	6.75			6.10			1 1/2	39 1/2	38 1/2	Sp
Clark 1D	T	4200	FF	I-G	7.60			6.00	7.00	7.25	1 1/8	39 1/2	38 1/2	Sp
Clark 2D	T	6500	FF	I-G	9.00			7.00	8.00	10.20	1 1/2	39	38 1/2	Sp
Clark 3D	T	11000	FF	I-G	10.00			11.00			1 1/2	42 1/2	40	Sp
Clark 5D	T	18000	FF	I-G	12.50			10.00	11.00		1 3/4	42 1/2	40	Sp
Columbia 10000	C		3/4-F	Sp-B	4.63			5.10	4.25		1 1/4	41	37	Sp&TA
Columbia 30000	C		3/4-F	Sp-B	4.40			4.67	4.10	4.87	1 3/8	41	37	Sp&TA
Columbia 50000	C		3/4-F	Sp-B	4.40			4.67	4.10	4.87	1 3/8	41	37	Sp&TA
Columbia 51000	T	3600	3/4-F	Sp-B	6.80			6.50	5.80	5.50	1 3/8	41	37	Sp&TA
Kenosha 30	T	5600		I-G	8.00			5.90	6.80		1 1/4	42	38	Sp
Kenosha. 4-wheel dv.	T	5600		I-G	6.70						1 1/4	42	38	Sp
Parker 21	T	4000		I-G	7.25			6.32	9.00			39	37	Sp
Parker 30	T	5000		I-G	7.25			6.32	9.00			39	37	Sp
Parker 40	T	7500		I-G	8.35			7.60	9.30			40	38	Sp
Peru FF	C		FF	Sp-B	4.50			4.25	4.75		1 11/32	40	35	Opt
Peru 3600	C		S-E	Sp-B	4.50			4.25	4.75		1 1/2	40	35	Sp&TA
Russel P1	T	2000	FF	I-G	7.00			7.70			1	40	38	Sp
Russel S1	T	4000	FF	I-G	8.85			7.4			1 1/4	39 3/4	39 3/4	Sp
Russel U1	T	5000	FF	I-G	9.45			7.80			1 1/4	40 1/4	39 3/4	Sp
Salisbury A	C		3/4-F	Sp-B	10.45			8.38			1 3/8	41 3/8	36 1/2	Sp&TR
Salisbury B	C & T.	2000	3/4-F	Sp-B	9.41			8.41	7.40		1 1/2	41 1/4	36 1/2	Sp
Sheldon W21	T	8000	S-F	W	7.75	8.75		9.50	10.33	17.66	1 7/8	39	32	Sp
Sheldon W500	T	2400	S-F	W	5.50			14.66			1 3/8	40	34	Sp
Sheldon W1001	T	3600	S-F	W	5.50	6.00		7.75	14.66		1 3/8	39	39	Sp
Sheldon W1501	T	4000	S-F	W	6.50	7.80		5.50	9.66	8.75	1 1/2	39	35	Sp
Sheldon W103	T	7000	S-F	W	6.50	7.75	8.66	5.50	10.66	14.66	1 11/16	39	32 1/2	Sp
Sheldon W31	T	12000	S-F	W	11.75	8.75	10.25				2 1/4	44	38	Sp
Sheldon W51	T	18000	S-F	W	8.75	10.25		13.00			2 7/16	46	43	Sp
Spacke M	C		3/4-F	Sp-P	57.12	49.11	54.11				1 1/4	41	35	Sp&TA
Timken-Detroit 5011	C		S-F	Sp-B	5.10						1 3/8	40 1/4	40 1/4	Sp
Timken-Detroit 5152	C		S-F	Sp-B	4.66			5.90	4.30	3.73	1 1/2	40 1/2	38 1/2	Sp
Timken-Detroit 5202	C		S-F	Sp-B	4.45			4.9	4.08	3.77	1 3/4	41	37	Sp
Timken-Detroit 5762	C		FF	Sp-B	4.08			4.90	4.45	3.77	1 5/8	39 1/2	39 1/2	T-A
Timken-Detroit 6250	T	1500	S-F	W	5.60			5.00	6.25	7.00	2	39	39	Sp
Timken-Detroit 6352	T	2000	S-F	W	7.20			5.16	6.20	8.25	2 1/4	39 1/2	37	Sp
Timken-Detroit 6460	T	3000	S-F	W	7.00			7.75	8.75	9.25	2 5/8	38 1/2	39 1/2	Sp
Timken-Detroit 6560	T	5000	FF	W	7.75			8.50	9.25		1 5/8	39 3/4	37	Sp
Timken-Detroit 6660	T	7000	FF	W	10.33			8.75	12.00		2	45	42 1/2	Sp
Timken-Detroit 6760	T	10000	FF	W	11.66			13.66			2 5/8	46 3/4	42 7/8	Sp
Torbenson OX2L	T	2700		I-G	6.65			8.00	5.30			40 1/4	37 1/4	Sp
Torbenson 750	T	2700		I-G	6.30			5.30				40 1/4	37 1/4	Sp
Torbenson A3	T	4200		I-G	7.16			8.23	6.30			39 1/2	37 1/2	Sp
Torbenson C3	T	7000		I-G	8.50			9.50	6.80			39	38	Sp
Torbenson E1	T	13000		I-G	10.20			11.60	9.00			44	39	Sp
Wisconsin 800G	T	4000	S-F	W	7.75			6.20	8.66		2 1/4	40	38	Sp
Wisconsin 800H	T	5500	S-F	W	8.25			7.25	9.33		2 3/8	40	38	Sp
Wisconsin 800J	T	7300	S-F	W	8.66			7.75	9.66		2 3/8	40	38	Sp
Wisconsin 900C	T	8800	S-F	W	8.66			9.66	10.66		3	41	38 1/2	Sp
Wisconsin 900D	T	12000	S-F	W	10.00			9.00	11.75		3 3/8	40	39	Sp
Wisconsin 900E	T	12000	S-F	W	10.00			9.00	11.75		3 3/8	44 1/2	42	Sp
Wisconsin 1000B	T	16000	S-F	W	11.75						3 3/4	46	40 3/4	Sp

# of Stock Axles

Provision for Radius Rods	Type of Differential	SERVICE BRAKE				EMERGENCY BRAKE			TYPE OF BEARINGS		Wheel Tread (In.)	Weight of Axle (Complete Unit Without Wheels)	Housing Material	Axle Shaft Material
		Location of Drum	Diameter of Drum	Width of Drum	External or Internal	Diameter of Drum	Width of Drum	External or Internal	In Differential	In Wheels				
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Yes	B	R-W	16	5	Int	16	3	Int	Roller	Roller	56½	480	P-S	S.A.E. 2335..
Yes	B	R-W	16	5	Int	16	5	Int	Roller	Roller	57½	550	P-S	S.A.E. 2335..
Yes	B	R-W	18	6¼	Int	18	6¼	Int	Roller	Roller	61	930	P-S	S.A.E. 2335..
Yes	B	R-W	18	6¼	Int	18	6¼	Int	Roller	Roller	61	960	P-S	S.A.E. 2335..
Yes	B	R-W	21	7½	Int	21	7½	Int	Roller	Roller	68½	1375	P-S	S.A.E. 2335..
Yes	B	R-W	24	7	Int	24	7	Int	Roller	Roller	75	1820	P-S	S.A.E. 2335..
Yes	B	R-W	16	5	Int	16	5	Int	Roller	Roller	56½	400	P-S	S.A.E. 3140..
No	B	R-W	14½	2⅝	Ext	14	2⅝	Int	Roller	Roller	56	.....	P-S	S.A.E. 3140..
No	B	R-W	15½	3⅜	Ext	15½	3⅜	Int	Roller	Roller	56	.....	P-S	S.A.E. 3140..
No	B	R-W	14	2¾	Ext	13⅝	2¾	Int	Roller	Roller	56	297	P-S	Nickel Steel..
No	B	R-W	12⅜	2¾	Ext	12	2¾	Int	Roller	Roller	56	250	P-S	S.A.E. 2335..
No	B	R-W	16	3¼	Int	15⅝	3¼	Int	Roller	Roller	56	379	P-S	Nickel Steel..
No	B	R-W	14	2	Ext	.....	.....	.....	Roller	Roller	56	375	M-I	Nickel Steel..
No	S-L	R-W	16	2½	Ext	15⅝	1½	Int	Roller	Roller	56	480	Steel	Nickel Steel..
No	B-S	R-W	16½	3	Ext	16	2½	Int	Roller	Roller	58	705	Steel	Nickel Steel..
No	B	R-W	20	3	Ext	9⅝	2½	Int	Roller	Roller	70	888	Steel	Nickel Steel..
No	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
No	B	R-W	12	2½	Ext	12	2½	Int	Roller	Ball	56	232	Steel	S.A.E. 2335..
No	B	R-W	14	2½	Ext	14	2½	Int	Roller	Ball	56	265	Steel	S.A.E. 2335..
No	B	R-W	16	3	Ext	16	3	Int	Roller	Roller	56	320	Steel	S.A.E. 2335..
No	B	R-W	16	3	Ext	16	3	Int	Roller	Roller	56	320	Steel	S.A.E. 2335..
Yes	B-SL	D-S	.....	.....	.....	7	4	Int	Ball	Ball	56½	425	Steel	Nickel Steel..
Yes	S-L	D-S	7	4	Int	.....	.....	.....	Opt	Opt	56½	425	Steel	Nickel Steel..
.....	B	.....	.....	.....	.....	.....	.....	.....	Ball	R.&B	56	400	C-S	.....
.....	B	.....	.....	.....	.....	.....	.....	.....	Ball	R.&B	56	425	C-S	.....
.....	B	.....	.....	.....	.....	.....	.....	.....	Ball	R.&B	60½	675	C-S	.....
No	B	R-W	12	2	Ext	12	2	Int	Roller	Roller	56	181	M.I	Ch.Va. Steel.
No	B	R-W	12	2	Ext	12	2	Int	Roller	Roller	56	190	M.I	Ch.Va. Steel.
No	B	R-W	14	3⅛	Ext	14	3⅛	Int	Roller	Roller	56	440	M.I	Ch.Ni. Steel.
No	B	R-W	16½	4⅜	Ext	16½	4⅜	Int	Roller	Roller	60	620	M.I	Ch.Ni. Steel.
No	B	R-W	18	4¼	Ext	18	4¼	Int	Roller	Roller	60¼	775	M.I	Ch.Ni. Steel.
No	B	R-W	14⅜	2¾	Ext	14	2¾	Int	Roller	Ball	56	248	P-S	Ch.Ni. Steel.
No	B	R-W	16⅜	2¾	Int	16	2¾	Int	Roller	Ball	56	294	P-S	Chrm. Steel..
No	B	R-W	18	2¼	Int	18	2¼	Int	Ball	Opt	Opt	.....	C-S	Nickel Steel..
No	B	R-W	12	1½	Int	12	1½	Int	Ball	Opt	56	.....	M-C	Nickel Steel..
No	B	R-W	14	1¾	Int	14	1¾	Int	Ball	Opt	56	.....	M	Nickel Steel..
No	B	R-W	16	2	Int	16	2	Int	Ball	Opt	57	.....	M	Nickel Steel..
No	B	R-W	16	2	Int	16	2	Int	Ball	Opt	Opt	.....	M	Nickel Steel..
No	B	R-W	20	2½	Int	20	2½	Int	Ball	Opt	69¾	.....	Steel	Nickel Steel..
No	B	R-W	24	3	Int	24	3	Int	Ball	Opt	73¼	.....	C-S	Nickel Steel..
No	B	R-W	14	2¼	.....	.....	.....	.....	Roller	Ball	56	270	P-S	S.A.E. 3135..
No	B	R-W	12	2	Ext	.....	.....	.....	Roller	Roller	56	190	P-S	Alloy Steel..
No	B	R-W	14⅜	1¾	Ext	14	1½	Int	Roller	Roller	56	260	P-S	Chrm. Steel..
No	B	R-W	15½	2½	Ext	15	2½	Int	Roller	Roller	56	295	P-S	Chrm. Steel..
No	B	R-W	16	2½	Ext	15½	2½	Int	Roller	Roller	56	395	P-S	Ch.Ni. Steel.
No	B	R-W	15	2½	Ext	15	2½	Int	Roller	Roller	56	420	P-S	Alloy Steel..
No	B	R-W	15	3	Int	15	3	Int	Roller	Roller	56	475	P-S	Alloy Steel..
No	B	R-W	16	3¼	Int	16	3¼	Int	Roller	Roller	58	660	P-S	Alloy Steel..
Yes	B	R-W	18	3½	Int	18	3½	Int	Roller	Roller	58½	855	P-S	Alloy Steel..
Yes	B	R-W	21	3¾	Int	21	3¾	Int	Roller	Roller	65¾	1300	P-S	Alloy Steel..
Yes	B	R-W	24	4	Int	24	4	Int	Roller	Roller	69½	1775	P-S	Alloy Steel..
No	B	R-W	14	3	Ext	13⅝	3	Int	Roller	Roller	56	270	.....	.....
.....	B	R-W	14	3	Ext	13⅝	3	Int	Roller	Roller	56	275	.....	.....
.....	B	R-W	15	3	Ext	14⅜	3	Int	Roller	Roller	56	365	.....	.....
.....	B	R-W	18	3	Ext	17⅞	3	Int	Roller	Roller	56	560	.....	.....
.....	B	R-W	19	3½	Int	10	4½	Ext	Roller	Roller	67½	1100	.....	.....
No	B	R-W	17	2½	Int	12¼	2½	Int	Ball	Ball	57½	550	M.I	Ch.Ni. Steel.
No	B	R-W	17	2½	Int	12¼	2½	Int	Ball	Ball	57½	640	M.I	Ch.Ni. Steel.
No	B	R-W	17	2½	Int	12½	2½	Int	Ball	Ball	57¾	700	M.I	Ch.Ni. Steel.
No	B	R-W	20	2½	Int	15½	2½	Int	Ball	Ball	59½	875	M.I	Ch.Ni. Steel.
No	B	R-W	20	2½	Int	15½	2½	Int	Ball	Ball	60	975	M.I	Ch.Ni. Steel.
No	B	R-W	20	2½	Int	15½	2½	Int	Ball	Ball	64	1000	M.I	Ch.Ni. Steel.
No	B	R-W	20	2½	Int	15½	2½	Int	Ball	Ball	70	1590	M.I	Ch.Ni. Steel.
No	B	R-W	24	3½	Int	18½	3½	Int	Ball	Ball				

Louisiana, Mississippi, Alabama. The amounts appropriated by these respective groups are as follows:

Agricultural	$201,000,000
Manufacturing	171,200,000
Southern	92,500,000
Mining	44,500,000

These figures show that road building activity is to be greatest in the agricultural states during the next year, even in proportion to population since the manufacturing states hold the majority of the people. This is a natural development since the manufacturing states were, of course, the first to develop good roads.

The presence of a good-sized appropriation for the South is an encouraging sign, since good roads are the chief factor still needed to make that section an excellent market for motor vehicles.

Funds Available for Road and Bridge Expenditures, 1921

Alabama	$9,000,000
Arizona	8,000,000
Arkansas	12,000,000
California	26,000,000
Colorado	7,000,000
Connecticut	8,000,000
Delaware	3,500,000
Florida	7,725,000
Georgia	10,000,000
Idaho	4,500,000
Illinois	20,000,000
Indiana	9,500,000
Iowa	37,000,000
Kansas	20,000,000
Kentucky	8,000,000
Louisiana	6,000,000
Maine	7,500,000
Maryland	4,800,000
Massachusetts	8,000,000
Michigan	20,000,000
Minnesota	20,000,000
Mississippi	11,000,000
Missouri	15,000,000
Montana	8,500,000
Nebraska	6,000,000
Nevada	3,500,000
New Hampshire	2,500,000
New Jersey	16,000,000
New Mexico	4,000,000
New York	55,000,000
North Carolina	6,500,000
North Dakota	7,000,000
Ohio	35,000,000
Oklahoma	8,000,000
Oregon	10,000,000
Pennsylvania	30,000,000
Rhode Island	1,700,000
South Carolina	6,000,000
South Dakota	7,000,000
Tennessee	10,275,000
Texas	60,000,000
Utah	6,000,000
Vermont	2,000,000
Virginia	10,000,000
Washington	14,000,000
West Virginia	8,000,000
Wisconsin	19,500,000
Wyoming	3,000,000
Total	$622,000,000

Texas also shows the largest road appropriation per capita of the large states; that is, of the states whose population is three million or more. Texas has appropriated $12.83 per capita for road expenditure during 1921 alone. California is second in this respect with an appropriation of $7.60 per capita. Following is the way the ten large population states line up as regards appropriation per capita:

Texas	$12.83
California	7.60
Ohio	6.08
Michigan	5.45
New York	5.32
New Jersey	5.10
Missouri	4.41
Pennsylvania	3.44
Illinois	3.09
Massachusetts	2.08

Specifications of Stock Gearsets

MAKE AND MODEL	Designed for	Type Clash or Individual Clutch	BEARINGS		Number of Speeds	WIDTH OF GEAR FACES					Gear Teeth Pitch	GEAR RATIOS					Gearset Location	Control Location	Housing Material	Shaft Material	Gear Material	Sold with Clutch?	Weight Lb. (With Controls but without Clutch)	MAKE AND MODEL
			Main Shaft	Secondary Shaft		Const. Mesh Set	Low	1st Inter.	2nd Inter.	Reverse		First	Second	Third	Fourth	Reverse								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Adco	Tr	Clash	B	P	1	7/8	...	...	...	7/8	6-8	....	....	....	1.00	1.42	A		C.I.	S.A.E. 2320.	S.A.E. 2320.	No.	.....	Adco
Adco 5A	T	Clash	R	R	4	1	1 1/4	1 1/4	1 1/4	1 5/16	6-8	4.00	2.61	1.50	1 00	4.84	A		Al	S.A.E. 2320.	S.A.E. 2320.	No.	.....	Adco 5A
Adco	C	Clash	B	P	3	5/8	5/8	5/8	5/8	5/8	7-9	3.00	1.21	1.00	....	3.62	U		C.I.	S.A.E. 2320.	S.A.E. 2320.	No.	.....	Adco
Adco	T	Clash	B	B	3	1	7/8	7/8	7/8	7/8	6-8	3.14	1.74	1.00	....	3.62	A		Al	S.A.E. 2320.	S.A.E. 2320.	No.	.....	Adco
Ball Gear BG3-4	C,T,Tr	Ind. Cl.	B	B	3	5/8	5/8	5/8	...	5/8	7-9	3.00	1.70	1.00	....	....	U	C	G.I. or Al	Nickel Van.	Chrome Nic.	Opt.	.....	Ball Gear BG3-4
Ball Gear BG1-2	C,T,Tr	Ind. Cl.	B	B	3	9/16	9/16	9/16	...	9/16	7-9	2.98	1.89	1.00	....	3.64	U	C	G.I. or Al	Nickel Van.	Chrome Nic.	Opt.	.....	Ball Gear BG1-2
Brown Lipe 50-4	T	Clash	R	R	4	7/8	1	1	1	1	6-8	4.84	2.84	1.76	1.00	5.81	A	C	G.I.	Chrome Stl.	Nickel Stl.	No.	137	Brown Lipe 50-4
Brown Lipe 30	C,T	Clash	R	B	3	5/8	3/4	3/4	3/4	3/4	6-8	3.33	1.68	1.00	....	4.35	U	C	G.I. or Al	Chrome Stl.	Nickel Stl.	Yes	140-105	Brown Lipe 30
Brown Lipe 60-4	T	Clash	R	R	4	1 1/4	1 1/2	1 1/2	1 1/2	1 5/8	5-7	4.84	2.84	1.50	1.00	5.81	A	S	G.I.	Chrome Stl.	Nickel Stl.	Yes	285	Brown Lipe 60-4
Brown Lipe 35-3	T	Clash	R	R	3	5/8	3/4	3/4	...	3/4	6-8	3.36	1.50	1.00	....	4.32	A		G.I.	Chrome Stl.	Nickel Stl.	.....	.....	Brown Lipe 35-3
Brown Lipe 35-4	T	Clash	R	R	4	5/8	1 1/16	3/4	3/4	3/4	6-8	5.35	2.84	1.76	1.00	6.25	A		G.I.	Chrome Stl.	Nickel Stl.	.....	122	Brown Lipe 35-4
Brown Lipe. UPP35-4	T	Clash	R	R	4	5/8	3/4	3/4	3/4	3/4	6-8	5.35	2.84	1.76	1.00	6.43	U	C	G.I. or Al	Chrome Stl.	Nickel Stl.	Yes	198 or 150	Brown Lipe. UPP35-4
Brown Lipe	T	Clash	R	R	4	7/8	1	1	1	3/4	6-8	5.35	2.84	1.76	1.00	6.43	U	C	G.I. or Al	Chrome Stl.	Nickel Stl.	Yes	211 or 147	Brown Lipe
Campbell C20	C	Ind. Cl.	B. & R.	P	3	3/4	3/4	3/4	3/4	3/4	6-8	3.52	1.73	1.00	....	....	U	C	M.I.	S.A.E. 2340.	S.A.E. 2340.	No.	125	Campbell C20
Campbell C20	C	Ind. Cl.	B. & R.	P	3	3/4	3/4	3/4	3/4	3/4	6-8	3.52	1.73	1.00	....	....	U	C	Al.	S.A.E. 2340.	S.A.E. 2340.	No.	85	Campbell C20
Campbell 50	T	Ind. Cl.	B. & R.	.....	4	7/8	7/8	7/8	7/8	7/8	6-8	4.00	2.62	1.50	1.00	4.81	A	Opt.	G.I.	S.A.E. 2340.	S.A.E. 2345.	No.	175	Campbell 50
Cotta 5S	T	Ind. Cl.	B	B	3	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	4 1/2-5 1/2	4.51	1.81	1.00	....	6.00	A	C	S.S.	S.A.E. 2345.	S.A.E. 2320.	No.	.....	Cotta 5S
Cotta 12SR	T	Ind. Cl.	B	B	3	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	4 1/2-5 1/2	4.51	1.81	1.00	....	6.00	A	C	S.S.	S.A.E. 2345.	S.A.E. 2320.	No.	.....	Cotta 12SR
Covert MUC	C,T	Ind. Cl.	B	B	3	1 5/16	1 5/16	1 5/16	...	1 5/16	6-8	3.62	1.91	1.00	....	4.46	U	C	C.I.	S.A.E. 2320.	S.A.E. 2320.	Opt.	115	Covert MUC
Covert SA4	T	Clash	B. & R.	R	4	1 1/16	1 1/16	1 1/4	1 1/16	1 5/16	5-7	5.07	3.04	1.63	1.00	6.76	A		C.I.	S.A.E. 2320.	S.A.E. 2320.	.....	.....	Covert SA4
Covert JT	Tr	Clash	B	R	3	1 1/16	1 3/4	1 1/16	...	1 1/16	5-7	1.83	1.00	.58	....	2.15	U	C	C.I.	S.A.E. 2320.	S.A.E. 2320.	Yes	.....	Covert JT
Covert L	C	Clash	B. & R.	R	3	5/8	11/16	11/16	11/16	11/16	7-9	3.61	1.82	1.00	....	4.50	U	C	C.I.	S.A.E. 2320.	S.A.E. 2320.	No.	85	Covert L
Covert RUC3	C,T	Ind. Cl.	B	B	3	7/8	1.0	1.0	...	5/16	6-8	3.62	1.60	1.00	....	4.37	U	C	C.I.	S.A.E. 2320.	S.A.E. 2320.	Yes	.....	Covert RUC3
Covert RA3	T	Ind. Cl.	B	B	3	7/8	1.0	1.0	...	5/16	6-8	3.62	1.60	1.00	....	4.37	A		C.I.	S.A.E. 2320.	S.A.E. 2320.	.....	.....	Covert RA3
Covert RU4C	T	Ind. Cl.	B	B	4	7/8	1 1/4	1.0	1.0	1.0	6-8	4.75	2.69	1.60	1.00	5.94	U	C	C.I.	S.A.E. 2320.	S.A.E. 2320.	Yes	.....	Covert RU4C
Covert R-A-P-4	T	Ind. Cl.	B	B	4	7/8	1 1/4	1.0	1.0	1.0	6-8	5.20	2.70	1.60	1.00	7.30	.....	.....	C.I.	S.A.E. 2320.	S.A.E. 2320.	.....	.....	Covert R-A-P4
Detroit CY	T	Clash	B	B	3	3/4	...	7/8	5/4	1	6-8	3.88	1.87	1.00	....	4.84	U	C	C.I. or Al.	Nic. or C. Stl.	Nic. or C. Stl.	Opt.	130	Detroit CY
Detroit DY	C,T	Clash	B	R. or P.	3	5/8	3/4	3/4	...	3/4	7-9	3.2	1.77	1.00	....	3.88	U	C or S	C.I. or Al.	Nic. or C. Stl.	Nic. or C. Stl.	Opt.	115	Detroit DY
Detroit H-HU	T	Clash	B	B	4	7/8	1	1	1	1 1/16	6-8	4.85	3.08	1.76	1.00	6.38	U or A	C	.....	Nic. or C. Stl.	Nic. or C. Stl.	Opt.	165	Detroit H-HU
Dundore F50	T	Clash	B	B	3	1	1	1	1	1	6-8	3.36	1.90	1.00	....	4.32	U	C	S.S.	S.A.E. 2345.	S.A.E. 2320.	No.	135	Dundore F50
Dundore M35	C	Clash	B	B	3	3/4	15/16	15/16	15/16	15/16	6-8	3.07	1.76	1.00	....	4.01	U	C	S.S.	S.A.E. 2345.	S.A.E. 2320.	No.	115	Dundore M35
Dundore K	C	Clash	B	B	4	3/4	3/4	3/4	3/4	3/4	6-8	2.69	1.56	1.00	.731	3.46	U-A	C	Al	S.A.E. 2345.	S.A.E. 6145.	No.	125	Dundore K
Durston	C,T	Clash	B	P	3	5/8	1	5/8	5/8	5/8	6-8	3.09	1.85	1.00	....	3.87	A	C	.....	Chr. Nickel.	Chr. Nickel.	No.	95	Durston
Fuller H	T	Clash	B	B	4	1 1/4	1 1/2	1 1/4	1 5/8	1 5/16	6-8	6.0	3.2	1.76	1.00	6.3	A		C.I.	Nickel Stl.	Nickel Stl.	No.	200	Fuller H
Fuller LTU	T	Clash	B	B	3	15/16	7/8	7/8	...	15/16	6-8	4.0	1.7	1.00	....	3.5	U-A	C	C.I.	Nickel Stl.	Nickel Stl.	Yes	85	Fuller LTU
Fuller GU7-8	T	Clash	B	B	4	15/16	1 1/16	7/8	7/8	7/8	6-8	4.8	3.0	1.60	1.00	6.5	U	C	C.I.	Nickel Stl.	Nickel Stl.	Yes	130	Fuller GU7-8
Fuller G7-8	T	Clash	B	B	4	15/16	1 1/16	7/8	7/8	7/8	6-8	4.8	3.0	1.60	1.00	6.5	A	C	C.I.	Nickel Stl.	Nickel Stl.	Yes	130	Fuller G7-8
Muncie T23N	C,T	Clash	B	B	3	3/4	15/16	...	2 13/32	15/16	6-8	3.0	1.82	1.00	....	3.9	U	C	G.I.	S.A.E. 2320.	S.A.E. 3120.	Yes	.....	Muncie T23N
Muncie T25	C,T	Clash	B	B. & P.	3	5/8	3/4	11/16	...	3/4	6-8	2.6	1.76	1.00	....	3.4	U	C	G.I.	S.A.E. 2320.	S.A.E. 3120.	No.	90	Muncie T25
Pittsburgh 34T	C,T	Clash	B	R	3	7/8	7/8	7/8	7/8	7/8	6-8	2.84	1.61	1.00	....	3.65	U	C	C.I. or Al.	S.A.E. 3140.	S.A.E. 3450.	Yes	.....	Pittsburgh 34T
Warner Gr. T60	C	Clash	B	R	3	11/16	3/4	3/4	...	3/4	6-8	3.24	1.63	1.00	....	4.05	U	C	C.I. or Al.	Steel	Steel	Opt.	105	Warner Gr. T60
Warner Gr. T53	T	Clash	B	B	4	1	1 3/8	1 1/4	1 1/4	1 3/8	5-7	4.99	3.16	3.17	1.00	5.78	A	C	C.I.	Steel	Steel	Sep.	195	Warner Gr. T53
Warner Gr. T38	C	Clash	B	B	3	3/4	3/4	2 13/32	...	3/4	.....	3.04	1.81	1.00	....	3.7	U	C	C.I. or Al	Steel	Steel	Yes	.....	Warner Gr. T38
Warner Gr. T38	T	Clash	B	R	3	3/4	3/4	2 13/32	...	3/4	.....	4.84	2.39	1.00	....	6.05	U	C	C.I. or Al	Steel	Steel	Yes	.....	Warner Gr. T38
Warren A	C,T	Clash	B	B	3	15/16	3/4	3/4	...	3/4	6-8	3.52	1.70	1.00	....	4.40	U	C	C.I.	S.A.E. 3120.	S.A.E. 2320.	No.	110	Warren A
Warren B	C,T	Clash	B	P	3	5/8	5/8	5/8	...	5/8	7-9	2.98	1.73	1.00	....	3.62	U	C	C.I.	S.A.E. 3120.	S.A.E. 2320.	No.	90	Warren B
Warren C	C,T	Clash	R	R	3	15/16	3/4	3/4	...	3/4	6-8	4.01	1.98	1.00	....	5.01	U	C	C.I.	S.A.E. 3120.	S.A.E. 2320.	No.	120	Warren C

ABBREVIATIONS—Column 1. **C**—Cars; **T**—Trucks; **Tr**—Tractors. Column 2. **Ind. Cl**—Individual Clutch. Columns 3 and 4. **B**—Ball; **P**—Plain; **R**—Roller. Column 17. **A**—Amidships; **U**—Unit with Engine. Column 18. **C**—Center; **S**—Side; **Opt**—Optional. Column 19. **C-I**—Cast Iron; **Al**—Aluminum; **M I**—Malleable Iron; **G I**—Grey Iron. Column 20. **Nickel Van**—Nickel Vanadium. Column 21. **Chrome Nic**—Chrome Nickel Steel.

An Analysis of the American Farm Lighting Plant Industry

1920 output approximately 100,000 plants valued at about $60,000,000. Seventy-five concerns manufacture about 140 models. Nearly 80 per cent are 32-volt systems. Twenty-five per cent still employ belt drive. Ninety per cent have single cylinder engines with an average of about 3 b.h.p.

By Gustave Wiedeman

THE isolated electric plant industry had in 1920 an output of about 100,000 plants valued in the neighborhood of $60,000,000. The last census shows that over two and one-half million farms still remain in this country without electrical service of any kind. At present, there are about 75 concerns manufacturing complete electric plants whose various models exceed 140.

The majority of plants are designed for general lighting and power work on small and medium sized farms. The average size of all models is 1.9 kw. Many of the units are purposely over-powered for auxiliary belt work.

Types.—The four classes or types of electric plants are: First, the 110-volt system, which employs no battery at all. It has practically disappeared. Second, the 110-volt system, using a small automobile type battery for starting purposes only. Three per cent of all models are of this class. Third, the 110-volt system (or 55 volts, optionally) having a full battery complement of 56 cells, constituting about 15 per cent of all models. Fourth, the 32-volt systems, having a full battery of 16 cells. About 80 per cent of all models fall in this class.

Thirty per cent of present electric plants are provided with auxiliary pulleys for a power take-off. These have surplus power so that belt work can be done while the plant is charging the battery. The ratio of engine power to generator output averages 3 to 1 where a power take-off is supplied and 2 to 1 where the engine drives only the generator.

Drive.—The belted plant was the pioneer in the electric plant field and to-day about 25 per cent of the models have belt drive. Six per cent of the plants have either gear or silent chain drive, which permit of efficient engine and generator speeds. This is usually an engine speed of about 1000 r.p.m. and generator speed of 2000 r.p.m. The remaining plants are all direct coupled.

Classification.—There are three kinds of electric plants, commonly referred to by the trade as (a) full automatic, (b) semi-automatic and (c) manually started. The full automatic plant starts and stops itself automatically during the line or battery charging period. In the case of 110-volt systems employing only a starting battery, a starting switch or the act of switching on the first light automatically starts up such a plant. The semi-automatic must be started by depressing a starting switch but is capable of shutting itself down when the battery is charged. The manual systems must be started and stopped and (usually) controlled by hand. This is the simplest plant of all and is most generally found in the smallest and the largest units, the intermediate sizes being of the other two kinds.

Regulation.—The life of the battery and the effectiveness of the plant depend largely upon the system of charge regulation. Charging regulation not only affects battery upkeep, conceded to be the most important item in electric plant maintenance, but also influences the operation of lamps whereby the satisfaction of a plant is measured.

The centrifugal governor is quite commonly used to hold the engine speed constant under all conditions or to restrict excessive speed by shutting off either fuel or air. A compound wound generator is best suited to this class of plants. The third system of regulation permits of varying engine speeds so as to produce a constant generator voltage. A solenoid, shunted across the generator terminals, actuates the throttle directly and produces a "tapered" charge, regardless of generator characteristics. Inherent speed regulation is occasionally used on the small units. Maximum engine speed is limited by manifold restriction or similar means. The principle of armature reaction is used in some cases to regulate plant charging.

Charge Control.—In the design of semi and full automatic plants, some principle must be selected which automatically determines the state of charge of the battery. Three such principles are in use, (a) the ampere-hour meter, (b) the voltage relay and (c) the specific gravity relay. The first of these is by far the most popular. Initially, the plant is started with the battery charged and the meter set at "full." Subsequently, every ampere-hour is added or subtracted, depending on whether it is a charge or discharge. A stopping relay commonly set at the "full" position of the meter serves to shut down the engine when that point is reached. These meters make an allowance for a battery efficiency of 80 per cent but their manufacturers recommend that they be "put in step" with the plant once a month by making a hydrometer check on their setting. The voltage relay system (b) is merely a set of relays, shunted across the battery, which act between pre-determined voltage limits and start or stop the plant charging accordingly. The specific gravity control (c) is usually worked out by employing a master cell hydrometer and using its rise and fall to actuate control relays.

Generator.—The four-pole generator appears most frequently, especially where the shunt winding is used for both generating and starting. Laminated fields are the rule. The shunt is the most popularly used field winding. The compound winding appears most fre-

Specifications of Isolated Electric

(Compiled for AUTOMOTIVE IN

Name and Model	PLANT					ENGINE							GENERATOR			BATTERY		Misc. (See Footnote)
	Voltage	Drive	Automatic Start?	Automatic Stop?	Unit or Separate Construction	No. Cyls. and Bore X Stroke	Fuel	Type of Speed Governor	Type Ignition	Type Lubrication	Normal r.p.m.	No. and Kind Engine Bearings	Rated K.W.	No. Poles and Kind Field Winding	No. and Kind Generator Bearings	Standard 72-hr. Rating	Open or Sealed	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Aerothrust	32	Dir	No	No	Unit	2-2½x2¼	G or K	Cent	Mag	C	1800		½	4-Shunt	2-Brnz	60	Sealed	a, g, o
Alamo	32	Dir	No	Yes	Unit	1-2¼x3¼	G	Sol	Mag	Pres	2000		1				Sealed	e, o, u, v
Allis-Chalmers	125	Dir	No	No	Unit	4-3½x4½	G	Cent	Mag	Pr.&Sp.	1150		5	4-Comp.	1-Brnz	Opt		
Allis-Chalmers	125	Dir	No	No	Unit	4-4½x6	G	Cent	Mag	Pr.&Sp.	1150		15	4-Comp.	2-Brnz	Opt		
American-Automatic	60	Dir	Yes	Yes	Unit	1-4 H.P.	G	Cent	Mag	Sp	800		1½	4-Shunt.	2	80		m, p
American-Automatic	60	Dir	Yes	Yes	Unit	2-8 H.P.	G	Cent	Mag	Sp	800		3	4-Shunt.	2	80		m, p
American-Automatic	110	Dir	Yes	Yes	Unit	4-12 H.P.	G	Cent	Mag	Sp	800		6	4-Shunt.	2	160		m, p
American-Automatic	110	Dir	Yes	Yes	Unit	4-16 H.P.	G	Cent	Mag	Sp	800		10	4-Shunt.	2	200		m, p
Chambers	32	Blt	No	No	Sepr	1-4 x4	G or K		Bat	O-Cup	550		1			107	Sealed	a, i, k
Cushman	32	Blt	No	Yes	Unit	1-4 x4	G		Bat	Sp	800	2-Bab	1	4-Comp.	2-Bab	130 175 260	Sealed	l
Delco-light	32	Dir	No	Yes	Unit	1-2½x5	G or K		Bat	Sp		B&R	¾			160	Sealed	g, o
Delco-light	32	Dir	No	Yes	Unit	1	G or K		Bat	Sp		B&R	1			160	Sealed	g, o
Delco-light	32	Dir	No	Yes	Unit	1	G or K		Bat	Sp		B&R	1¼			160	Sealed	g, o, i
Delco-light	32	Dir	No	Yes	Unit	1	G or K		Bat	Sp		B&R	1¼			160	Sealed	g, o
Delco-light	110	Dir	No	Yes	Unit	1	G or K		Bat	Sp		B&R	2½			160	Sealed	g, o
Dynelectric																		w
Dyneto	32	Chn	No	Yes	Sepr	1-4 H.P.	G	H&M	Mag	Sp	800		1¼			80		g, k
Dyneto	32	Blt	No	Yes	Sepr	1-1½ H.P.	G		Bat	Sp			¾			53		k
Dyneto	32	Blt	No	Yes	Sepr	1-1½ H.P.	G		Bat	Sp			¾			80		k
Dyneto	32	Blt	No	Yes	Sepr	1-1½ H.P.	G		Bat	Sp			¾			110		k
Essandee																		s
Everlite	32	Dir	No	Yes	Unit	1-2¾x4	G or K	None	Bat	Sp	1250	2-Ball	1¼	2-Comp.	1-Brnz	94 141 189 236 277	Sealed	n, l
Electrion	32	Dir	No	Yes	Unit	1-2¾x3	G or K	Sol	Mag	Sp	1600	2-Ball	1	2-Comp.	1-Brnz	115	Sealed	j, m, o, u, p
Electrion	32	Dir	Yes	Yes	Unit	1-2¾x3	G	Sol	Mag	Sp	1600	2-Ball	1	2-Comp.	1-Brnz	115	Sealed	j, m, o, u, p
Electrion	110	Dir	Yes	Yes	Unit	1-2¾x3	G	Sol	Mag	Sp	1600	2-Ball	1	2-Comp.	1-Brnz	72	Sealed	j, m, o, q, u, p
Fairbanks-Morse	32	Dir	No	No	Sepr	1-1½ H.P.	G or K		Mag	Pr	500	Bab	¾	2-Shunt	2-Ball	84	Sealed	e
Fairbanks-Morse	32	Dir	No	No	Sepr	1-3 H.P.	G or K		Mag	Pr	475	Bab	1½	2-Shunt	2-Ball	224	Sealed	e
Fairbanks Co	32	Dir	No	No	Unit	1-3½x3¼	G or K		Bat	Sp	1150	2-Bab	1	2-Comp	2-Ball	120 160	Sealed	h, i, l
Farm-Lite	32	Dir	No	No	Unit	1-3½x3¾	G or K	Cent	Mag	Sp	1200		1¾	4-Shunt		120	Sealed	k
Farm-O-Lite	32	Blt	Yes	Yes	Unit	1-3 H.P.	G or K	Cent	Bat	Sp	700		1			160		k
Farm-O-Lite	32	Blt	Yes	Yes	Unit	1-3 H.P.	G	Cent	Mag	Sp	800		1½			120		k
Farm-O-Lite	32	Dir	Yes	Yes	Unit	1-3½ H.P.	G	Cent	Mag	Sp	1100		1¼			200		k
Fort Dearborn	32	Gear	No	Yes	Unit	1-2¾x5	G or K	Cent	Mag	Sp	1000	2-Ball	1	4-Shunt	2-Brnz	240	Sealed	g, o
Frost	32	Blt	No	Yes	Sepr	1-1½ H.P.	G						¾					
Frost	32	Blt	No	Yes	Sepr	1-2½ H.P.	G						1					
Genco-Light	32	Dir	No	Yes	Unit	1-3½x3	G or K		Bat	Sp	1200	2-Bab	1	2	2-Ball	110	Sealed	o
Genco-Light	110	Dir	No	Yes	Unit	2-3½x4	G or K		Bat	Sp	1200	2-Bab	3	4	2-Ball	167	Sealed	o
Genco-Light	110	Dir	No	Yes	Unit	4-3½x4	G or K		Bat	Sp	1200	2-Bab	6	4	2-Ball	250	Sealed	o
Globe	32	Dir	No	No	Sepr	1-2¾x4	G	Cent	Bat	Sp	1200		.8	2-Shunt	2-Ball	120	Sealed	k
Globe	32	Dir	No	Yes	Sepr	1-2¾x4	G or K	Cent	Bat	Sp	1200		1	2-Shunt	2-Ball	110 150 180	Sealed	n
Gray-Davis	32	Dir	No	No	Unit	1-2½x2½	G or K	None	Bat	Sp	1150	2-Ball	½	4-Shunt		56	Sealed	g, k
Hebco	32	Dir	Yes	Yes	Sepr	1-3 x3	G	Sol	Bat	Sp	1600	2-Bab	1½	4-Shunt	Bab	120	Sealed	m, y
Holt	110	Dir	Yes	Yes	Sepr	1-2⅝x3	G	Sol	Bat	Sp	1400	2-Bab	¾	4-Shunt	Bronze	80		m, r, pr
Independent	32	Gear	No	Yes	Unit	1-3½x4	G or K		Bat	Sp	750	2-Bab	1½	4-Comp.	2-Brnz	95 140 190 235 275	Sealed	k
Ker-o-el	32	Dir	No	Yes	Unit	1-2⅝x3¼	G or K	Cent	Bat	Pr	1550	2-Bab	⅞	4-Comp.				h
Kewanee	32	Dir	No	Yes			G		Bat		1250							k
Kewanee	32	Blt	No	Yes			G		Bat		1250							k
Kohler	110	Dir	Yes	Yes	Unit	4-2 x3	G	Cent	Mag	Sp	1000	2-Brnz	1½	4-Comp	1-Ball	26		pr
Lally-Light	32	Dir	No	Yes	Sepr	1-2⅝x2	G	Cent	Bat	C	1800	3-Ball	1¼	2-Comp.	2-Ball	115		a, c, o
Langstadt-Meyer	32	Dir	No	No	Sepr	1-3½x4½	G or K		Bat	Pr	1250		1½			134		k
Langstadt-Meyer	110	Dir	No	No	Sepr	4-3½x4½	G	Cent	Mag	Pr	1100	Bab	6	4-Comp.		Opt		k
Langstadt-Meyer	110	Dir	No	No	Sepr	4-2½x4	G	Cent	Mag	Pr	950	Bab	4	4-Comp.		Opt		k
Langstadt-Meyer	110	Dir	No	No	Sepr	4-2½x4	G	Cent	Mag	Pr	1100	Bab	5	4-Comp.		Opt		k
Lebby	32	Dir	No	Yes									½					
Litscher-Lite	32	Dir	No	No	Unit	1-3 x4½	K	Cent	Bat	Sp	1150	2-Bab	1	4-Shunt	2-Ball	140 420	Sealed	i, k
Lucolite	32	Dir	No	Yes	Unit	1-3¼x3¼	G or K		Bat	Sp	1150	3-Bab	1¼	2-Comp.	2-Ball	144	Sealed	h, i, l, o
Lucolite	110	Dir	No	Yes	Unit	1-3¼x3¼	G or K		Bat	Sp	1150	3-Bab	1¼	2-Comp.	2-Ball	288	Sealed	h, i, l, o
Main	32	Blt	No	Yes	Sepr	1	G or K	Cent	Mag	Sp	500	2-Bab	¾	2-Shunt	2-Bab	140	Sealed	k
Main	32	Dir	Yes	Yes	Unit	1-2⅝x2½	G or K	Sol	Mag	Sp	1500	2-Bab	1	2-Comp.	2-Bab	140	Sealed	a, k
Main	32	Dir	No	Yes	Sepr	1	G or K	Cent	Mag	Sp	450	2-Bab	1	2-Comp.	2-Bab	140	Sealed	k

ABBREVIATIONS:

Column 2. **Dir**—Direct.
Chn—Chain.
Blt—Belt.

Column 5. **Sepr**—Separate.
Column 8. **Sol**—Solenoid.
Cent—Centrifugal.
H & M—Hit and miss.
Column 10. **Sp**—Splash system.

Pr—Pressure system.
O-Cup—Oil cup or sight feed.
C—Oil mixed with fuel.
Column 12. and 15. **Bab**—Babbitt.
B & R—Ball and Roller.

Column 14. **Comp**—Compound.
Column 16. **Opt**—Optional.
Column 18. **a**—2 Cycle. } Otherwise
b—Semi-Diesel. } 4 cycle.
c—Oil mixed with fuel.

quently with its series winding used for starting only although there are many generators where the series winding is employed for bucking or compensating regulation. The duplex winding is confined to the 110-volt system that uses only a starting battery, where a shunt is normally used for generating and a 12- or 24-volt winding for cranking only.

Whenever possible, designers have used generator characteristics for charge regulation, sometimes alone and more frequently in combination with some engine characteristic.

Safety or protective devices are used on all plants. Fuses appear usually on the simplest plants. The magnetic circuit-breaker is increasing in popularity for

Lighting and Power Plants, 1921

DUSTRIES by Gustave Wiedeman)

Name and Model	PLANT: Voltage	Drive	Automatic Start?	Automatic Stop?	Unit or Separate Construction	ENGINE: No. Cyls. and Bore X Stroke	Fuel	Type of Speed Governor	Type Ignition	Type Lubrication	Normal r.p.m.	No. and Kind Engine Bearings	GENERATOR: Rated K.W.	No. Poles and Kind Field Winding	No. and Kind Generator Bearings	BATTERY: Standard 72-hr. Rating	Open or Sealed	Misc. (See Footnote)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Marco	32	Chn	No	No	Sepr	1-5 H.P.	G or K	Cent	Mag	Sp	800		1½					g, z
Marco	32	Chn	No	No	Sepr	1-5 H.P.	G or K	Cent	Mag	Sp	800		1½					g, z
Matthews	32	Dir	Yes	Yes	Unit	1-2 x3	G	Sol	Bat	Sp	1200		.3	4-Shunt	2	80	Sealed	m, o, p
Matthews	32	Dir	Yes	Yes	Unit	1-3 x3	G	Sol	Bat	Sp	1000		1	4-Shunt	2	80	Sealed	m, o, p
Matthews	110	Dir	Yes	Yes	Unit	4-3½x5	G	Sol	Bat	Sp	900		6	4-Shunt	2	80	Sealed	m, o, p
Mayhew	32		No	Yes		1-2¾x4	G or K		Bat		1400	Bab	1	4-Comp		90		
Mayhew	32		No	Yes		1-2¾x4	G or K		Bat		1400	Bab	1	4-Comp		120		
Mayhew	32		No	Yes		1-2¾x4	G or K		Bat		1400	Bab	1	4-Comp		160		
Merrell	32	Blt	No	Yes		1-3 H.P.	K						¾					
Merritt	32	Dir	No	Yes	Unit	1-3 x4	G or K	Cent	Bat	Pr	1200	Bab	1½	4-Comp		120	Sealed	h, o
Mills	32	Blt	No	Yes		1-1½ H.P	G or K						¾					
National	32	Chn	No	Yes	Unit	1-5 H.P.	G or K	Cent	Mag	Sp	800	Bab	1	4-Shunt	Ball	280	Sealed	g, i, o
National	110	Chn	No	Yes	Unit	1-5 H.P.	G or K	Cent	Mag	Sp	800	Bab	2	4-Shunt	Ball	280	Sealed	g, i, o
Owen	32	Dir	Yes	Yes	Unit	1-3 x4	G	Cent	Bat	Pr	1350	Roll	1¼	4-Comp		120	Sealed	f, p
Perfection	32 to	Dir	No	Yes	Sepr	1-3⅝x4	G or K		Bat	Sp	1150	2-Bab	1½	2-Comp	2-Ball	56 to	Sealed	n, t
Perfection	110	Dir	No	Yes	Unit	1-3¼x3¼	G or K		Bat	Sp	1150	2-Bab	1½	2-Comp	(1 Bab. (1-Ball	448		n, t
Petroleum																		b, w
Phelps	32	Dir	No	Yes	Sepr	1-3 x4	G or K	Cent	Bat	Sp.&Pr.	1335	2-Ball	1½	4-Comp	2-Ball	(135 (225	Sealed	i, o
Pioneer	32	Blt	No	No	Sepr	1-5 H.P.	G or K	Cent	Bat	Sp	600	2-Bab	1	4-Comp	Bronze	115		a, k
Pioneer	65	Blt	No	No	Sepr	1-5 H.P.	G or K	Cent	Bat	Sp	600	2-Bab	to	4-Comp	Bronze	to		e, k
Pioneer	110	Blt	No	No	Sepr	1-5 H.P.	G or K	Cent	Bat	Sp	600	2-Bab	2½	4-Comp	Bronze	320		k
Plix	32	Dir	No	Yes	Unit	1-3 x3	G	Sol	Mag	Sp	1200	2-Bab	1¼	4-Shunt	1-Bab	112	Sealed	j, s
Powerlite	32	Dir	No	Yes	Unit	1-3¼x3¼	G or K	Cent	Bat	Sp	1400	2-Bab	1	2-Series	Ball	80	Sealed	m, o
Powerlite	32	Dir	No	Yes	Unit	1-3¼x3¼	G or K	Cent	Bat	Sp	1400	2-Bab	1	2-Series	Ball	160	Sealed	m, o
Radiant	32	Dir	No	No	Unit	1	G or K	Sol	Bat	Sp	2100		.3	2-Comp	Bab	36	Sealed	m
Radiant	32	Dir	No	No	Unit	1	G or K	Sol	Bat	Sp	2100		1½	2-Comp	Bab	72	Sealed	m
Radiant	110	Dir	No	No	Unit	4	G or K	Sol	Bat	Sp	1300		3	2-Comp	Bab	53	Sealed	m
Radiant	110	Dir	No	No	Unit	4	G or K	Sol	Bat	Sp	1300		5	2-Comp	Bab	80	Sealed	m
Radiant	110	Dir	No	No	Unit		G or K	Sol	Bat	Sp	1300		10	4-Comp	Bab	80	Sealed	m
Reeco	32	Dir	No	No	Sepr	1-3 H.P.	G or K		Mag	Sp	475	Bronze	1¼	4	Bab		Sealed	s
Regalite	32	Dir	No	Yes	Unit	1-3¼x3½	G or K	None	Bat	Sp	700	Bronze	¾			80	Open	g
Rohaco	32	Dir	No	No	Unit	1-3 x4	G or K	Cent	Bat	Pr	1200	Ball	1½	4-Comp	2-Ball	170	Sealed	l
Silvey	110 to	Blt	No	No		2 H.P.	G or K						1 up					
Silvey	220	Blt	No	No		up	G or K											
Stearns	32	Dir	No	No	Unit	1-2⅝x3	G or K	Sol	Mag	Sp	1500	2-Ball	¾	2-Comp	1-Bab	126	Open	m, o, x
Sturtevant	32	Dir	No	No	Unit	4-3½x5	G or K	Cent	Mag	Pr	900	2-Bab	5	6-Comp	1-Bab			
Sturtevant	to	Dir	No	No	Unit	4-4 x6	G or K	Cent	Mag	Pr	750	3-Bab	10	6-Comp	1-Bab			
Sturtevant	250	Dir	No	No	Unit	6-4 x6	G or K	Cent	Mag	Pr	750	4-Bab	15	6-Comp	1-Bab			
Sunbeam	32	Dir	Yes	Yes	Unit	1-2¼x3	G	Sol	Bat	Sp	1400	2-Ball	.65	4-Shunt		75	Sealed	m, p
Sunnyhome	110	Dir	Yes	Yes		1-2½ H.P.	G			Pr	2000	Roller	1¼			36		H, m, p
Suburban	32 to	Blt	No	No		1-1½ to	G						3 to					
Suburban	110	Blt	No	No		1-10 H.P.	G						4½					
Swanlite	32	Dir	No	Yes	Unit	1-3 x4	G or K	None	Bat	Sp	1250	2-Bab	1¼	4-Comp	2-Bab	277	Sealed	m
Swanlite	32	Dir	No	Yes	Unit	4-3½x5	G	Cent	Mag	Sp	1200	3-Bab	5	4-Comp	2-Brns	Opt	Sealed	k
Swartz-Light	32	Dir	No	Yes	Unit	1-3 x3¼	G	Sol	Mag	O-Cup	850	2-Bab	1	4-Comp	1-Ball	225	Sealed	a, m
Swartz-Light	32	Blt	No	Yes	Sepr	1-5 x6½	G	Cent	Mag	O-Cup	450	2-Bab	1½	4-Comp	2-Ball	225	Sealed	m
Swartz-Light	110	Blt	No	Yes	Sepr	1-5 x6½	G	Cent	Mag	O-Cup	475	2-Bab	2¾	4-Comp	2-Ball	225	Sealed	m
Syco-Light	32 to	Dir	No	Yes		1-2½ to	G			Sp			⅘ to			160		k
Syco-Light	250	Dir	No	Yes		4-8 H.P.	G or K			Sp			12			160		l
Unilectric	110	Dir	Yes	Yes	Unit	1-2¾x3½	G	Sol	Mag	Pr	1600	(1-Bab (1-Ball	1	2-Shunt		80		e, m, r, y, p
United	32	Blt	No	Yes	Sepr	1-4½x6	G or K	Cent	Bat	O-Cup	425	2-Bab	1	4-Shunt	2-Brns	(110		k
United	32	Dir	No	Yes	Unit	1-3¼x3¼	G or K	Cent	Bat	Sp	1150	3-Bab	1	4-Comp	1-Ball	150 (180	Sealed	m
Universal Motor	32	Dir	No	Yes	Sepr	4-2 x3	G	Sol	Mag	Sp	1250	2-Bab	2	6-Shunt	1-Ball	250	Sealed	m
Universal Motor	110	Dir	No	No	Sepr	4-2⅝x4	G	Cent	Mag	Sp	1100	2-Bab	4	8-Comp	1-Brns	168	Sealed	k
Universal Products	32	Dir	No	Yes	Unit	1-2⅝x3½	G or K	Cent	Mag	Sp	1100	2-Brns	1	4-Comp		168	Sealed	o
Warner	32	Dir	No	No	Sepr	1-1¾ to	G						⅔ to					
Warner	32	Dir	No	Yes	Sepr	1-22 H.P.	G or K						3⅗					
Warner	110	Dir	No	Yes	Sepr	1-3½ to	G or K						1¼ to					
Warner	110	Blt	No	Yes	Sepr	1-22 H.P.	G or K						4⅗					
Wesco	32	Dir	No	No	Unit	1-3¼x3¼	G or K	None	Bat	Sp	1150	Bab	1	2-Shunt	Ball	Opt		i, l
Western Electric	32	Dir	No	Yes	Unit	1-3½ H.P.	K	Cent	Bat	Sp	1000		1½			90		g
Western Electric	32	Dir	No	Yes	Unit	1-3¼ H.P.	K	Cent	Bat	Sp	1000		1½			180		g
Western Electric	110	Blt	No	No	Sepr	5 to 25 H.P.	K	Cent	Mag	Sp			to 12			270		l
Willys-Light	32	Dir	No	Yes	Unit	1-2⅞x3½	G or K		Bat	Sp	1250	2-Bab	1¼	4-Shunt		225	Sealed	d, g, o
Winton	110	Dir	No	No	Unit	4-3 x4	G	Cent	Bat	Pr	1200	2-Bab	5	4-Comp	1-Bab			
Winton	250	Dir	No	No	Unit	6-3 x4	G	Cent	Bat	Pr	1200	2-Bab	7½	4-Comp	1-Bab			
Wisconsin	32	Blt	No	No	Sepr	1-4 x5	G or K		Bat		425	Bab	.60	Shunt				k
Wisconsin	32	Blt	No	No	Sepr	1-4½x5½	G or K	Cent	Bat		400	Bab	.84	Shunt		180		k
Wisconsin	32	Blt	No	No	Sepr	1-3½x4½	G or K	Cent	Bat		450	Bab	.60	Shunt		130		k
Wisconsin	32	Blt	No	No	Sepr	1-5½x6	G or K	Cent	Bat		340	Bab	1.08	Shunt		210		k

d—Knight sleeve valve.
e—Rotating sleeve valve.
f—Rotating disk valve.
g—Air cooled.
h—Air and water cooled
H—Oil cooled.
} Otherwise poppet.
} Otherwise water cooled.

i—Power pulley.
j—Entirely enclosed.
k—Rheostat control.
l—Manual throttle control.
m—Auto. Solenoid control.
n—Auto. Voltage relay.
o—Ampere-hour meter.
p—Auto. start and stop relay.
r—Starting battery only.
s—Designed for export sales.
t—Some Ford parts used.
u—Low-water safety device.
v—Low-oil safety device.
w—Product being re-designed.
x—Plant may be used without battery.
y—Remote control.
z—Engine easily disconnected.

the semi-automatic plant. Reverse current relays are a necessity with semi and full automatic plants, to protect the generator and battery against damage in case the engine stops.

Control Panels.—The manually controlled plants have rather elaborate control boards, consisting of ammeter, voltmeter, rheostat, switches, etc. Semi-automatic plants have, as a rule, the simplest control boards, consisting of a ampere-hour meter and a pair of controlling switches. The full automatic plants are made "fool proof" by concealing their control panel or compartment,

(*Continued on page* 421)

Specifications of Continental Agricultural Tractors

Compiled for AUTOMOTIVE INDUSTRIES by W. F. Bradley

Name and Nationality	Traction	No. of Cyl.	BORE AND STROKE		Total Weight Lbs.	Lubrication System	Carbureter	Air Clnr.	Water Circ.	Type Clutch	No. of Speeds	Final Drive	Axle Type	NO. OF WHLS.		Frame Construction	Eng. and Gears
			M.M.	Inches										Drive	Non-Drive		
FRENCH																	
Abeille	Cr.	4	80x115	3.15x4.53	3,080	Pump.	.....	Yes.	Pump.	Disk.	3	Gear.	Stat.	1	2	None.	Unit.
Amiot‡	Wh.	4	105x160	4.14x6.32	5,500	Pres.	Super.	No.	Pump.	Cone.	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Auror*†	Wh.	4	80x140	3.15x5.52	3,500	Pres.	Claudel.	No.	Pump.	Cone.	3	Int. G.	Stat.	4	0	Roll Ch.	Separ.
Austin	Wh.	4	95x127	3.75x5. 0	2,900	Pres.	Zenith.	Yes.	Ther.	Cone.	2	Dbl. Red.	Live.	2	2	.....	Unit.
Chapron	Wh.	4	75x130	2.95x5.13	2,525	Pres.	Zenith.	No.	Pump.	Cone.	3	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Charmes	Wh.	4	120x150	4.73x5.92	.....	Pres.	Solex.	No.	Pump.	Cone.	3	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Citroen	Wh.	4	65x100	2.56x3.94	1,760	Pres.	Solex.	No.	Ther.	Cone.	2	Bevel.	Live.	2	2	None.	Unit.
De Dion	Ca.	4	125x150	4.93x5.92	.....	Pump.	Zenith.	No.	Pump.	Plate.	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
De Dion	Ca.	4	100x140	3.94x5.52	.....	Pump.	Zenith.	No.	Pump.	Plate.	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Delahaye	Wh.	4	100x160	3.94x6.32	8,800	Pres.	Claudel.	No.	Pump.	Cone.	2	Int. G.	Stat.	3	0	Roll Ch.	Separ.
Delieuvin*	Wh.	4	85x130	3.35x5.13	3,300	Pres.	Zenith.	No.	Pump.	Plate.	2	Dbl. Red.	Stat.	3	2	Roll Ch.	Separ.
Dubois	Wh.	4	80x140	3.15x5.52	2,000	Pres.	Claudel.	No.	Ther.	Cone.	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Filtz	Ca.	4	100x150	3.94x5.92	4,000	Pump.	Solex.	No.	Pump.	Plate.	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Latil	Wh.	4	105x140	4.14x5.52	5,300	Pres.	Solex.	No.	Ther.	Cone.	2	Chain.	Stat.	2	2	Roll Ch.	Separ.
Mistral	Wh.	4	100x140	3.94x5.52	3,800	Pump.	Solex.	No.	Pump.	Disk.	2	Int. G.	Stat.	2	2	Roll Ch.	Separ.
Normania	Wh.	4	100x140	3.94x5.52	.....	Pres.	Zenith.	No.	Pump.	Cone.	2	Chain.	Stat.	2	0	Roll Ch.	Separ.
Peugeot	Cr.	4	100x150	3.94x5.92	6,200	Pres.	Zenith.	No.	Pump.	Cone.	2	Gear.	Stat.	2	0	None.	Separ.
Renault	Cr.	4	95x160	3.75x6.32	7,200	Circ.	Own.	No.	Ther.	Cone.	3	Gear.	Stat.	2	0	None.	Separ.
Rip*	Wh.	4	114x143	4.5 x5.64	4,400	Circ.	Kingst.	Yes.	Pump.	Disk.	7	Int. G.	Stat.	2	2	Roll Ch.	.....
Scemia	Wh.	2	105x150	4.14x5.92	3,500	Pres.	Own.	Yes.	Ther.	Cone.	2	S. Gear.	Live.	2	2	Roll Ch.	Separ.
Scemia	Wh.	2	140x205	5.52x8.08	5,800	Pres.	Own.	Yes.	Ther.	Cone.	2	S. Gear.	Live.	2	2	Roll Ch.	Separ.
Somua	Wh.	4	98x170	3.86x6.70	5,500	Pres.	Claudel.	No.	Pump.	.....	4	Dbl. Red.	.....	2	1	None.	Unit.
Valere-Chochod*	Wh.	4	90x150	3.55x5.92	5,300	Pres.	Zenith.	No.	Pump.	Cone.	2	Chain.	Stat.	4	0	Roll Ch.	Separ.
ITALIAN																	
Fiat‡	Wh.	4	105x180	4.14x7.10	5,900	Pres.	Own.	Yes.	Pump.	Disk.	3	Worm.	Live.	2	2	None.	Unit.
Pavesi†	Wh.	2	130x170	5.13x6.70	5,100	Pres.	Own.	No.	Pump.	Disk.	2	Int. G.	Stat.	4	0	None.	Separ.

ABBREVIATIONS: **Ca**—Cable; **Circ**—Circulating; **Cr**—Creeper; **Dbl. Red**—Double Reduction; **Int. G**—Internal Gear; **Pres**—Pressure; **Roll. Ch**—Rolled Channel; **S. Gear**—Spur Gear; **Stat**—Stationary; **Ther**—Thermo-syphon; **Wh**—Wheel. *All makers use their own engine except as follows: Auror and Valere-Chochod use Ballot; Delieuvin uses DeDion and Rip uses Waukesha. †Pavesi has horizontal engine; all others vertical. ‡Kerosene burning. All others burn gasoline. All makes use gear type oil pump, magneto ignition and gravity fuel feed.

Pneumatic Equipment and Heavy Trucks

PROBABLY no question in the truck field has caused more discussion during recent years than that of pneumatic tire equipment.

Partially complete returns from a recent survey made by AUTOMOTIVE INDUSTRIES indicate a rather general unanimity of opinion on this question among truck manufacturers. Most manufacturers feel, in a general way, that the 3½-ton truck is the largest that can economically be equipped with pneumatic tires, although some believe that pneumatic equipment is not efficient on trucks larger than 2½ tons. A still smaller number think that pneumatic equipment is effective on models larger than 3½ tons.

The point was brought out, however, in a number of replies that not only the weight of the trucks but the operating purposes and conditions need to be considered when discussing the advisability of pneumatic equipment in any particular case. One manufacturer, for instance, says, " . . . We do not advocate the use of pneumatics on 3½-ton jobs unless the nature of the service has been carefully analyzed and sufficient assurance obtained that the tires would not be badly overloaded and that operating conditions are such as to enable this type of equipment to justify its higher cost . . . . We do not yet feel that trucks of this class can be indiscriminately sold on pneumatic equipment."

While a majority of those replying stated their belief that 3½-ton trucks were the largest upon which pneumatics might satisfactorily be used, some of this group was rather doubtful as to the real advisability of so equipping trucks of this size. In other words, while they felt it could be done, they are not thoroughly sold on the advisability of doing it except in special cases. One opinion ran like this: " . . . It is our opinion that pneumatic equipment reaches its limits on trucks of 2½-ton capacity, because of the fact that to withstand the hard wear and weight of the 3½-ton truck, the tires would have to be built so large that they could not be conveniently used. And furthermore, the solid tires of the large truck usually have large enough traction area, so there is no excuse for pneumatic equipment on these grounds."

Another general belief brought out by the survey was the opinion of most manufacturers that there would be a tendency towards the increased use of middle-sized trucks and a falling off in the use of the very large sizes. One manufacturer stated that, "We are firm believers in the fact that the heavy capacity truck is doomed and will be replaced with a greater number of medium capacity trucks. This we find is the condition existing all over the country, except, perhaps, in twelve or fifteen of the larger cities."

One maker thinks that the size of future trucks will be limited to the practicability of pneumatic tire sizes; that trucks will be built as large as can economically be operated on pneumatics and no larger.

Judging from the general opinions expressed as regards the attitude of the public towards pneumatic equipment for trucks of capacity of three tons and up, there is little question but that the public is rather skeptical in this regard. The following typical statements express the general opinion:

"We believe the general public in buying 3-ton sizes or over consider hard tires an investment as against the pneumatics as a speculation."

"No demand from public for pneumatic equipment on sizes of 3 tons or more."

"Attitude of public in this regard is that such equipment is not satisfactory."

While dissenting opinions are to be noted from all of the general trends indicated, a majority of truck manufacturers seem to believe in a general way the points outlined above in regard to the use of pneumatic equipment on trucks.

Billion Dollar Mark Passed in Automotive Exports

A study of the figures compiled since 1907 indicates a steady growth. Many interesting changes shown in the trend of trade since the war. Last year's total, $382,676,437, covering practically all countries.

By George E. Quisenberry*

THE foreign trade of the United States in passenger cars, trucks, motorcycles, parts, gas tractor engines and tires reached the huge total of $382,676,437 in 1920, an increase of slightly more than $175,000,000 over the preceding year. By expanding its overseas business by so great a value, the industry pushed its total export sales for all years well above the billion dollar mark, the statistics showing that the world has bought from the makers of this country $1,319,548,810 in these lines in all years since 1907.

All of the component automotive lines combined in rolling up the increase in 1920. Passenger car exports jumped from $73,700,527 to $165,255,921; trucks gained an approximate $11,000,000 to a 1920 total of $46,765,781; parts value rose from $42,562,186 to $85,362,093; the tire exports were $52,570,103, as against $28,924,659; engines from $20,026,172 to $21,965,959, and motorcycles grew from $6,687,346 to $10,756,580.

The detailed statistics follow.

	1919	1920	All Years
	24,481	37,662	126,313
Motorcycles	$6,687,346	$10,756,580	$30,963,518
	67,144	142,508	526,592
Passenger cars	$73,700,527	$165,255,921	$517,614,256
	15,485	29,126	115,236
Commercial vehicles	$35,424,337	$46,765,781	$271,904,722
Parts	$42,562,186	$85,362,093	$257,288,041
Gas tractor engines	$20,026,172	$21,965,959	$95,268,260
Tires	$28,924,659	$52,570,103	$149,570,013
Total value	$207,325,227	$382,676,437	$1,319,548,810

This does not include the aeronautic exports, of which the official reports reveal shipments of 65 airplanes, valued at $598,274, and airplane parts valued at $544,375. The corresponding totals in 1919 were 44 planes, worth $215,300, and parts valued at $3,249,266.

Records Inadequate

Unfortunately, the showing of car exports does not reflect the true volume of American automobiles which were placed in the overseas markets during the past year. The customs records give these at 142,508, a figure which in itself is sufficiently large to reveal something of the world demand for the automotive products of the United States but which, nevertheless, does not adequately point the way for calculations on replacements, accessories, maintenance parts, future markets, etc.

The reason is that pioneer figure in our foreign trading, Henry Ford. For several years, the Ford company has been establishing assembly branches in various centers which put together Ford cars from parts shipped from the Detroit factory. These, naturally, are not listed as either complete cars or chassis, but as parts, which take a different customs rating, and so do not show properly in the returns. But they are assembled into cars which should be considered as American products. For servicing and maintenance, they require spark plugs, for instance, of American sizes and other accessories of a similar nature, and they are in reality the product of American factories.

These assembling branches are located at Saõ Paulo, Brazil; Buenos Aires, Argentina; Manchester, England; Cadiz, Spain; Bordeaux and Copenhagen. Another factor is the shipment of Ford cars from the Canadian factory to those British possessions which have preferential tariff arrangements with that country. Ford has not announced the total assemblies of the foreign branches or the shipments from Canada on this basis, but, without doubt, they would swell materially the volume of American cars put in the foreign markets last year.

The Saõ Paulo branch, which has attained a reported production of 700 cars a month, takes care of only Southern Brazil, while the Buenos Aires plant, which has run as high as 1500 cars monthly, confines its sales entirely to the Argentine. All other countries of Latin-America are supplied with Ford cars and trucks from this country and show as complete cars or chassis in all cases. No Ford cars show for the Argentine and but part of those for Brazil, a condition which also exists in regard to the countries in Europe served from the European branches.

The maximum production at Manchester has been above 8,000 cars monthly, according to a recent statement, although early last year it ranged from 3,000 a month to 1,000 weekly. The Cadiz plant probably runs about 700 a month, whereas Bordeaux and Copenhagen have averaged much less.

Where Exports Go

With these factors in mind, as modifying the relative standings, a review of the 1920 exports of passenger cars, according to value and based on the customs reports, shows that England, India, Canada and Australia were the chief purchasers of complete cars and chassis. Following them come New Zealand, South Africa, Cuba, Sweden, Brazil, Dutch East Indies, Argentina, Spain, Uruguay, Philippine Islands and Mexico. Denmark, which had ranked seventh, and Norway, which had been twelfth in 1919, both dropped so low in 1920 that they did not come among the first fifteen buyers.

The purchases, according to number of machines, were

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somewhat different, although England and India were again the leaders, but Australia was ahead of Canada. After these leaders the relative order was South Africa, New Zealand, Cuba, Sweden, Argentina, Dutch East Indies, Uruguay, Mexico, Spain, Philippine Islands and Brazil.

Through all years, the fifteen leading countries in the purchase of American made cars have been Canada, England, Australia, Argentina, New Zealand, South Africa, Cuba, India, Mexico, Dutch East Indies, Philippine Islands, France, Uruguay, Japan, the Netherlands and Chile. The details of these statements may be gathered from the tables which are published elsewhere in this issue.

The countries in 1920 which purchased fewer cars than in the year before were Denmark, the Azores, Finland, France, Iceland, Chile, Roumania, British Honduras, Canada, Newfoundland and Labrador. The cars purchased by Brazil were less by 22 in 1920 but the value rose surprisingly from $2,580,304 to $6,761,382.

Among the smaller countries, there were some unusual gains between the two years, this being an evidence that the American made motor car is pushing itself into all corners of the world.

Some of these are shown in the following table:

	1919	1920
Portuguese Africa	18	244
Korea	11	595
French East India	37	537
Persia	4	128
Turkey	119	1010

Turning to the truck field, Brazil pushed prominently into the forefront of buyers. Ranking seventeenth in 1919, this Latin-American country was in fourth place last year, being exceeded only by England, Canada and Cuba, and leading India, Australia, Mexico, Japan, the Philippines and Peru, in the order named. The Brazilian gain was more than 700 per cent, from 200 to 1540. British India, the Dutch East Indies and Peru were other countries which also made surprising gains, these being as follows:

British India	266 to 1534
Dutch East Indies	324 to 1182
Peru	207 to 900

Two bright spots among the small countries which are taking their place in the truck buying field are the Virgin Islands and the Dominican Republic. The Virgin Islands, which are now American territory, made a percentage gain far surpassing anything shown in any of the other purchasing territories. One truck was sent there in 1919; in 1920 the number was 168. The Dominican Republic also made a favorable showing, taking 213 trucks as against 48 in the preceding year.

The Truck Trade

Truck exports, the comparisons show, do not always follow the motor car, although that should logically be the pioneer wedge by which any territory is opened up for automotive equipment. But, once opened, the utilization of trucks and cars may follow different lines. Three countries, for instance, appear among the first fifteen buyers of motor trucks which are not shown in the same list for passenger cars. These are Japan, Peru and West Africa, each of which increased its takings in 1920, although the early advent of the business depression in Japan prevented that country from making the gains recorded by the other two territories. On the other side of the ledger was France, which, after leading in 1919, almost dropped out of the truck market in 1920.

On the buying of tires, a much different line-up of leading purchasers was shown, the list being led by England and followed by Cuba and the Argentine. The English takings were $4,178,548, Cuba $3,409,986 and Argentina $3,126,889. The latter country, perhaps, in this comparison shows up for the first time more nearly where it should be considered as a user of American automotive equipment. Because of the big Ford assembly plant at Buenos Aires, its absorption of passenger cars and trucks is imperfectly given in the customs reports. On tires, however, this does not follow and the breadth of the market is shown without the possibility of any modification being needed.

The Argentine, in third place, was well ahead of Canada, which was followed in turn by Sweden, Philippine Islands, France, New Zealand, Brazil, Spain, Netherlands, South Africa, Dutch East Indies, Australia and Mexico. India, which had been so high in the other comparisons, was no more than nineteenth as a tire buying country.

From a constructive standpoint, a study of these exports evidences that the entire world has become a field of sale for American automotive equipment. Even the smallest countries have been buying cars and trucks. A common statement is that, whereas North America has nine million automotive vehicles, the rest of the world has but a million, or one-ninth as many. The exactness of the estimate may be questioned, but there can be no doubts here of the magnitude of the markets now confronting the American maker and the development that may be expected in coming years.

Markets Cover Every Country

Motor car and truck use outside the continental borders of the United States has expanded to an extent that two or three years ago would scarcely have been credited as possible. The American makers have been forced into foreign trade either by intention or by chance. The main point is that they are there and must stay there. The equipment already sold must be serviced and replaced; new services are being opened, and, for all of this, the American manufacturer must keep himself in the export business.

The year 1920 has been a prolific one in the sense of experience gained and lessons learned. The makers, as a whole, are better equipped today than they were twelve months ago for upholding the obligations that foreign trade has forced upon them. But the fundamentals still remain and, although our last year's trade was far in excess of that of any previous period, there can be no slackening now. Advertising, salesmanship, promotion for good roads, careful packing, the use of foreign language literature for both sales and service, proper servicing and maintenance, all of these factors must be rigidly held in upbuilding a foreign policy that will hold the markets already gained.

ACCORDING to information furnished by the Governor-General of French Western Africa, the number of automobiles imported into Senegal in 1918 was 91 (of which 85 were American and 6 French) besides 25 American trucks. In 1919 (December excepted) there were imported 94 cars, of which 87 were American and 7 French, and in addition 31 American trucks. Practically all of the American cars were of Ford and Overland make.

As regards the preferences of the population, vehicles for the country should be light, strong and of an average of 20 hp. They should have a low center of gravity and yet have plenty of ground clearance, owing to the fact that roads have hardly been broken. For city use vehicles are preferred which are heavier, more comfortable and of an average of 12-15 hp.

Canada Has 403,111 Cars and Trucks in Use

1920 totals show 13.4 per cent increase over 1919, the actual gain being 47,678. This article analyzes the Canadian registration figures and also comprises a thorough and valuable review of the present status and future prospects of the automotive industry in Canada. Tariff wall will remain high on automotive products, except on small tractors.

By Garnett Clay Porter

CANADA'S official registration of automobiles for 1920 totals 403,111. This is an increase over the 1919 registration of 47,678 cars, or 13.4 per cent. The increase of 1919 registration over that of 1918 in the Dominion was 85,706 cars.

The 1920 increase was by no means as marked as in other years. Reasons assigned by the trade quite agree as to the cause. Increased price was not so much a factor as inability of agents to guarantee delivery on orders placed in the winter of 1919-20. In the winter of 1918-19 the demand had been enormously in excess of manufacturers' capacity. The armistice brought a flood of orders. Money was the cheapest thing in the Dominion. The agrarian interests were never so flourishing. Men from the farm were in the market for cars whose pre-war conception of luxuries was confined to a fairly serviceable single horse buggy. Others with cheap grades of cars were discarding them for the more expensive types. In other words, Canada, like the rest of the world, was reacting from the rigid economies enforced by war conditions.

Frenzy of Spending in 1919

Three dollar wheat was no longer a mere figment of an optimistic rural imagination. Thousands of orders were taken following the close of the war and deposits made, with no guaranty of delivery and with the price to be determined "at time of delivery." This was the condition in Canada generally ruling in the trade in the winter of 1918-19. Then came the abolition of the government wheat board which had handled the crop so profitably to Canadian farmers in 1918-19. This machinery was expected to operate during 1920, but Ottawa authority desired to see the old supply and demand law of commerce re-established as soon as possible. The beginning had to be made with the great basic industries. All the political influence of the vast agrarian bund of the Dominion, commonly known as the United Grain Growers, was insufficient to change the Ottawa decision.

GRAIN PRODUCTION 1920, IN BUSHELS

Saskatchewan	298,474,200
Alberta	177,475,400
Manitoba	127,895,400
Total	604,445,000

Indeed, the spending frenzy had reached such proportions that the Dominion Government imposed a luxury tax to slow down the wheels of the spending multitude. It was particularly trying, this tax, on the automobile industry. In this trade the tax was known as an excise impost and was 15 per cent on all cars under $3,000 and 20 per cent over that amount.

As an offset, the 7½ per cent war tax added to the customs duty was abolished. This helped the United States manufacturers in the Canadian market, but proved really an additional burden to the manufacturers of cars in Canada. It meant to the Canadian trade that the already high price of cars had to be increased to the buying trade at least 15 per cent. The uncertainty of the grain market slowed down the buying in rural districts. These were the conditions which handicapped the automotive industries in the Dominion in 1920. Late in the fall of last year the orders for cars to be delivered this spring were appreciably less.

But then came another reaction, due to the abolition of the luxury tax and the excise burden. Prices came down to that extent and the new year opened with business prospects good. Various representatives of the trade from coast to coast have informed the writer that during January their orders increased enormously. All predict a prosperous year for the trade in Canada, especially in the west.

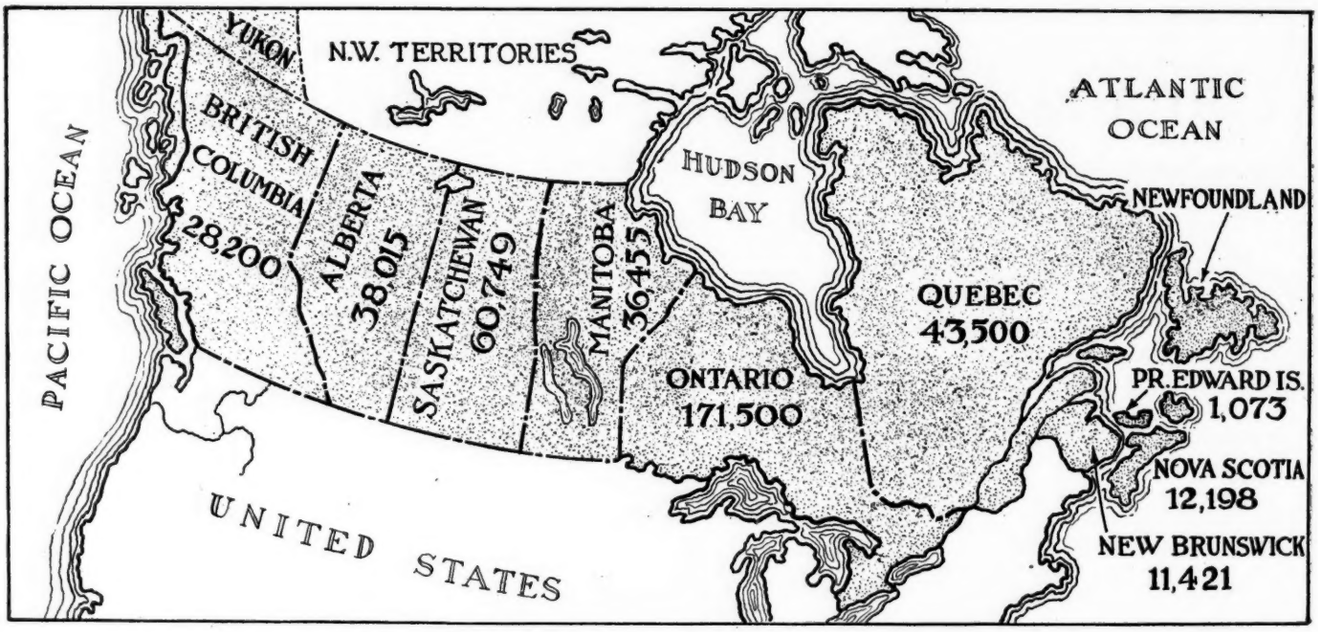
Tractor Demand Increases

In the three prairie provinces there were, during 1920, 31,998 farm tractors as against 26,832 in 1919. These are not official government registration figures, as the provinces do not require owners of farm tractors to register them. There were compiled from records of the grain growers, agricultural societies and customs offices.

OFFICIAL REGISTRATION OF AUTOMOBILES IN CANADA FOR TEN YEARS

TOTAL FOR 1920, 403,111, INCREASE OVER 1919, 13.4 PER CENT

Year	Ont.	Sask.	Que.	Alta.	Man.	B. C.	N. S.	N. B.	P. E. I.	Total
1911	11,339	1,304	1,878	1,631	2,599	2,220	228	483	...	21,682
1912	16,266	2,268	3,535	2,505	4,770	4,289	456	700	...	34,789
1913	23,700	4,659	5,452	3,773	5,406	6,138	511	824	26	50,489
1914	31,724	8,027	7,413	4,728	7,001	6,688	544	1,260	30	67,415
1915	42,346	10,225	10,112	5,832	8,812	7,440	971	1,900	35	87,673
1916	54,375	15,000	15,347	9,703	11,953	8,576	1,728	2,986	50	120,318
1917	83,790	32,500	21,702	20,800	17,333	11,386	5,678	5,249	301	198,739
1918	109,374	47,239	28,338	29,500	24,389	15,828	8,103	6,475	481	269,727
1919	151,623	54,754	40,557	34,362	33,896	19,050	10,981	9,420	790	355,433
1920	171,500	60,749	43,500	38,015	36,455	28,200	12,198	11,421	1,073	403,111



Motor vehicle registration in various Canadian provinces

TRACTOR RECORD ON PRAIRIES FOR FOUR YEARS

	1917	1918	1919	1920
Saskatchewan	8,610	10,937	14,207	16,907
Alberta	3,977	5,209	7,122	8,700
Manitoba	1,613	3,631	5,503	6,391
Total	14,200	19,777	26,832	31,998

The impression is very general that 1921 will show a huge increase in the demand for tractors. The Federal Government has placed some 30,000 ex-service men on farms in the west. Many of them produced good crops last year. This year they will be potential buyers of farm tractors and automobiles. To appreciate the possibilities of the western Canadian farm for automotive industries it must be recalled that in 1920 there were cultivated 29,279,000 acres, and the total grain production of the three prairie provinces was 604,445,000. An increase of fully 20 per cent. is indicated for 1921, due to virgin sod being broken and the exceptional season last year for the fall plowing, which, in these northern latitudes, is always the big problem.

No Duty on Small Tractors Likely

President W. H. Gibson of the Saskatchewan Livestock Association, at the annual meeting of that organization at Moosejaw, Sask., Jan. 25, declared that prairie farmers were beginning to prefer the horse again to the tractor, and the secretary's annual address asserted that "the tendency of our farmers is to swing back from high priced tractors to really good draft horses." But the automotive trade record does not bear out this forecast, for a new factory was opened at Saskatoon, Sask., in 1920 for the manufacture of the light prairie tractor, and a similar plant was opened at Medicine Hat, Alta. In fact the abolition of the customs duty on the $1,400 tractor type proved such a lure to the United States manufacturers of tractors that the manufacturers on this side have been doing everything they could since the close of the war to have the duty reimposed. The writer was over the country with Sir Henry Drayton, Minister of Finance, sitting with other members of the Federal cabinet as a tariff commission last fall. At both Saskatoon and Medicine Hat representations were made by tractor manufacturers to have the customs duty on the $1,400 tractor re-established.

In this connection the writer thinks it important to the manufacturer of both tractors and automobiles in the United States that he emphasize this: There is little probability, in fact only the remotest, of the Dominion Government's policy concerning the tariff regulations on tractors and automotive production of every description being changed. I took special note of the attitude of Sir Henry Drayton, chairman of the Tariff Commission, during the session at Medicine Hat last fall, when the manager of the new plant producing farm tractors there submitted his brief urging a resumption of the tariff on the small type of tractor, such as he was turning out. I recall distinctly that Sir Henry Drayton bore down on this point in interrogating the manager of the tractor manufacturing company: "But you knew when you established your plant for the manufacture of this class of tractors that your industry was not protected by the tariff?" Senator Robertson, the other member of the commission, nodded his head as if in agreement with the idea brought out by the chairman.

MUNICIPAL DISTRIBUTION OF CARS, 1920; RURAL EXCESS, 119,145

	Cities	Village, Town, Townships
Ontario	63,478	108,022
Saskatchewan	18,213	42,436
Quebec	13,791	29,709
Alberta	11,341	26,674
Manitoba	14,322	22,133
British Columbia	12,377	15,823
Nova Scotia	4,121	8,077
New Brunswick	3,988	7,433
Prince Edward Island	352	721
Total	141,983	261,128

The commission, of course, has been investigating industrial conditions all over the Dominion with a view of submitting facts as the members find them. Their personal views will not prevail, but the policy of the Meighen Federal Government is strongly one of protective tariff generally, but with a tendency to treat the implements of production rather from the farmers' point of view. The Meighen government has a majority in Parliament at present of thirty. The next Federal election will occur in the late spring of 1922. It can be safely predicted that no resumption of the duty on $1,400 tractors will be made by this government, nor will there be any

reduction in that time of the duty on automobiles.

The duty on small tractors was removed as a war time measure to increase production. It has worked so well and proven so popular that in spite of the manufacturers of this type of tractors in Canada there is little probability of the duty ever being re-established.

The political complexion of the next government is in doubt. The country is rather evenly divided between the National Liberal and Conservative party now in power at Ottawa, the Farmers, and the Liberals. The Meighen government is openly pledged to a protective tariff policy. The Liberal strength is chiefly in Quebec, and that French province is largely a protective tariff section, though the Liberal platform calls for "such changes in the tariff as the needs of industry may require," while the farmers rather are inclined to free trade, in farm implements at least.

With the basis of political calculations vastly disturbed in Canada, it is still a pretty safe prediction that the elements opposed to any considerable change in present tariff relations will control the destinies of the Dominion for at least five years after the next election. The attitude of the Washington authorities in placing an embargo, or advocating such an embargo, on wheat and cattle, which Canada sends so heavily into the States, has strengthened the element on this side which is opposed in principle to reducing the customs wall. So automobile manufacturers in the States may make up their minds that they will continue to climb the tariff wall to get into Canada, and those manufacturing the small type of tractor may rest assured that there is unlikely to be a duty reimposed on their products coming over the line to the northward.

Canadian Oil Industry

In this connection, those interested in the oil and gasoline industry should study the situation now developing on this side of the line, for it is certain to loom large on the horizon of the trade before the close of the year. The Imperial Oil Co. of Canada, which is the Canadian name for the Standard, has definitely located a new oil field in the Mackenzie River basin at a point some 1000 to 1500 miles north of rail head in the Northwest Territories. Two wells have been drilled and one is unquestionably a gusher, flowing, on the best evidence that has come up from the Arctic, 1500 barrels daily. The importance of the discovery is suggested by the suspension of all regulations by the Dominion Government of oil and mineral land leases.

Energetic efforts are being made to get the Mackenzie River products onto the market. It is freely predicted that this petroleum will be a factor in the world market by this fall. A railroad is projected over the 16-mile portage which obstructs the all-water route via the Mackenzie River, Great Slave Lake, the Peace River and their tributaries to the rail head at Peace River Crossing, Alberta. There are indications that tank steamers will operate on both sides of this short portage, across which a pipe line will be constructed, to rail head. That public sentiment will permit these products to go out of the country in their raw state is quite remote. The probabilities are that all refining will be forced on the Canadian side of the line.

Large Potential Market for Automotive Products

But this means an era of cheaper gasoline and oil in Canada if not in the States. This is one of the imponderable factors in estimating the possible potentiality of the Canadian market for the automotive industry in the future. The trade estimates that each car will use annually 275 gallons of gasoline, at 40 cents, giving a total money value of the quantity at $44,342,210 for 1921, or 110,895,525 gallons. Each of these cars will use four tires in 1921, or 1,612,444 at estimated value of $40,321,100. Each car will use for grease one-tenth of the value of gasoline consumed, estimated at $4,434,221, and it is estimated that 10 per cent of the value of a car is consumed each year in accessories, giving a possible expenditure for 1921 in Canada of $80,622,200, or a total expenditure for the cars as per registration this year in Canada of $169,719,731.

POTENTIAL BUSINESS FOR 1921 IN CANADIAN AUTOMOBILE INDUSTRY, BASED ON 1920 RECORDS

Each car will use four tires, 1,612,444; probable total value	$40,321,100
Each car consumes 275 gallons gasoline, 110,895,525 gallons, value	44,342,210
Ten per cent value, all cars spent annually in accessories	80,622,200
Cars will use one-tenth value of gasoline in grease and oil	4,434,221
Total probable expenditures of cars in service 1921	$169,719,731

It is worth noting in considering these registration figures that some members of the trade deduct 5 per cent from all registrations for duplications. Undoubtedly this uncertain quantity accounts for some disputes in totals. When a car is sold to another user, he applies for a license. These duplications are weeded out at some of the capitals better than in others, but the feature is worth noting.

The registration shows 355,550 cars registered as passenger cars and 47,561 as commercial cars; but E. M. Trowern of Ottawa, who presented the brief before Sir Henry Drayton at Ottawa in December, when a plea was being made for the remission of the excise duty on cars on which the tax had been paid before it was abolished last fall, estimated that "about 85 per cent of all the cars sold in Canada are used for business purposes."

PASSENGER CARS, COMMERCIAL CARS AND MOTORCYCLES BY PROVINCES

December 31, 1920

	Passenger Car	Commercial Car	Motorcycles
Ontario	155,500	16,000	5,500
Saskatchewan	51,514	9,235	3,125
Quebec	36,098	7,402	2,410
Alberta	33,094	4,921	2,040
Manitoba	31,827	4,628	3,209
British Columbia	25,056	3,144	1,611
Nova Scotia	11,098	1,100	980
New Brunswick	10,511	910	527
Prince Edward Island	852	221	....
Totals	355,550	47,561	19,535

It was from the Trowern brief that the following figures were secured. He recorded for the benefit of the Dominion of Finance Minister that: "The number of employees in the Canadian automobile factories is 20,000. There are 5,550 dealers actually merchandising cars in Canada. Allowing eight employees to each establishment gives a total of 44,000. If you allow five to a family of all these, a total is given of 320,000 direct dependents upon the automotive industries of Canada."

It is worth noting that the Government did not refund the tax on cars in stock of dealers at the time the tax was abolished, upon the theory that when the tax was imposed it did not apply to cars then in the hands of dealers. The leaders of the industry are still urging action in this direction, however. In actual operation, the failure to secure this rebate will mean that those dealers who have cars on sale on which they have paid the tax must lose same, as new cars delivered will be sold at a price proportionately less to the trade. This tax had to be paid at the time the car passed from factory to dealer.

CARS PER CAPITA ON PRAIRIES

	Population	Cars 1919	Per Cap.	Cars 1920	Per Cap.
Saskatchewan ...	647,835	54,754	11.8	60,749	10.7
Manitoba	553,860	33,806	16.8	36,455	15.6
Alberta	496,525	34,806	14.3	38,015	12.9
Total	1,698,220	122,922		135,219	

Increase over 1919 of 21,347 cars.

Prairies Form Chief Market

While Ontario and Quebec are big users of cars, the prairies continue to be the rich field for the business. For the three prairie provinces, with a population of 1,698,220, registered last year 135,219 cars as compared with 122,922 in 1919, an increase of 21,347. The four western provinces show 326 repairshops, 1117 garagemen and 1669 dealers. The estimated value of cars registered in the four western provinces for 1920 is $343,179,900 and $70,384,600 for tractors. The use of tractors and motor trucks for drawing grain to market is increasing all over the prairies. This is the testimony submitted at the annual meetings of the western grain growers, where it was said that even on bad roads 75 bushels could easily be handled by small tractors and motor trucks. In 1919 there were 89 distinct makes of cars registered in western Canada, and for 1920 the different makes had increased to 112. That these roads must improve for this traffic is indicated by increased revenue being devoted to road purposes all over Canada, $20,000,000 now being in sight for this purpose in Manitoba alone. The automobile leagues of Canada are responsible for this fine spirit, the Ontario Motor League alone increasing its membership in 1920 from 6607 to 11,115. Many agricultural societies are establishing tractor schools and the western universities are encouraging such departments.

REPAIRSHOPS, DEALERS AND GARAGEMEN IN WEST

	Shops 1919	Shops 1920	Garagemen 1919	Garagemen 1920	Retail Car Dealers 1919	Retail Car Dealers 1920
Saskatchewan	84	97	451	478	493	541
Alberta	55	63	198	214	380	394
Manitoba	95	105	284	321	415	510
British Columbia...	43	61	123	104	184	224
Total	277	326	1,056	1,117	1,472	1,669

INVESTED CAPITAL IN CARS THROUGH WEST AND POSSIBILITIES—AVERAGE PRICE IN WEST $2,100 PER CAR—AVERAGE TRACTOR $2,200 PER MACHINE

	Cars, 1920	Value	Tractors	1920 Value	Grain Acreage 1920
Sask.	60,749	$127,752,900	16,907	$37,184,400	16,270,000
Alta.	38,015	79,831,500	8,700	19,140,000	7,140,000
Man.	36,455	76,555,500	6,391	14,060,200	5,769,000
Brit. Col.	28,200	59,220,000	....	.....	.....
Total ..	163,419	$343,179,900	31,998	$70,384,600	29,279,000

These figures are authentic as far as they go, according to the Federal Government records at Ottawa. In many of the Canadian factories, so much of the car parts turned out complete are imported, chiefly from the States, that it is difficult to figure the extent of the purely Canadian industry and the number of cars each factory produces. The tendency, however, is for the United States factories to extend their assembly plants here and rely wholly on the factory product on this side to accommodate this growing Canadian market. There were ten automobile manufacturers registered in Canada in 1919 and eleven in 1920. One large factory is being established now at Winnipeg which is not included in this list, and there are several other old munition factories that will be equipped during 1921 for the manufacture of whole or parts of cars.

These factories turned out, in 1919, 89,900 cars, valued at $70,000,000, with 17,542 employees; while in 1920 they completed 94,421 cars, at a value of $78,000,000, and employed 20,000 persons. These values are those given for taxation purposes at the factories. In 1919 the cars and parts imported were valued at $29,768,000, and in 1920 these importations had fallen to $27,900,000. The manufacturing end of the cars for the Canadian territory is expected to increase considerably this year.

MANUFACTURERS IN CANADA AND IMPORTATIONS

	1919	Factory Value	1920	Factory Value
Total factories in Canada ..	10		11	
Number cars turned out..	89,900	$70,000,000	94,421	$78,000,000
Number employees in factories ..	17,542		20,000	
Number retail dealers in cars and parts	5,265		5,500	
Cars imported valued at ..	$29,768,000		$27,900,000	

Recent Motor Vehicle Lighting Laws in the Chief Canadian Provinces

(Latest Available Reports)

Province	Headlights	Regulations for Dimming	Spotlights and Searchlights
Alberta	Lights of moving or standing vehicles must be visible 200 ft. ahead and must display license number in figures 1 in. high.	The direct beam of light must not rise above 42 in. at a point 75 ft. ahead.	"No motor vehicle shall carry what is known to the trade as a searchlight."
British Columbia.	Efficient lights required. Lamp glass must display license number in black figures 1 in. high.	Lamp glass must be ground or painted.	No searchlights, intermittent lights or flashlights are allowed.
Manitoba	Lights must be visible 200 ft. ahead without glare.	Non-glare lens or other device is required and must be approved by the Municipal Commissioner or inspectors.	No searchlight is allowed on any motor vehicle.
New Brunswick..	Lights must be visible a reasonable distance.	Dimmers or non-glare lights are required.	No special law.
Nova Scotia	Lights visible a reasonable distance are required 1 hr. after sunset until 1 hr. before sunrise.	Lights must not dazzle.	
Ontario	Lights clearly visible 200 ft. are required.	No light over 4 cp. equipped with a reflector shall project a beam over 42 in. high at a point 75 ft. or more ahead.	Subject to laws governing headlights and dimming.
Quebec	Lights visible reasonable distance required.	Due precaution against glare must be taken.	No dazzling lights are allowed.
Saskatchewan ...	Lights must be visible 200 ft. under normal atmospheric conditions and reveal person 100 ft. ahead and 10 ft. to either side.	Lights must be permanently dimmed to prevent glare.	No special law.
Toronto	Lights must be clearly visible 200 ft.	No light of over 4 cp., equipped with a reflector, shall rise above 42 in. 75 ft. or more ahead.	No pivoted light allowed, or any light that can be projected in different directions.

The Trend of the Oil Industry in 1920

Year proves the most remarkable in history in nearly all respects. Commanding features are unusually large production, rapidly mounting imports, failure to locate quota of new pools, rapid rise of prices in first quarter and overproduction accompanied by declining prices near close.

By Joseph E. Pogue[1]

IN practically all respects 1920 was the most remarkable year in the history of the petroleum industry. The commanding features of the twelve months just ended, so far as the automotive industry is concerned, were five in number: the unusually high volume attained by the domestic production of crude petroleum; the rapidly mounting imports of crude oil from Mexico; the failure of an active drilling campaign to bring in its due quota of new pools; a rapid rise of oil prices during the first quarter of the year; and the development of a period of overproduction accompanied by declining prices toward the close of the year.

Crude Petroleum.

The production of crude petroleum in the United States in 1920 attained the surprising total of 447 million barrels,[2] an advance of 18 per cent over the output of 378 million barrels characteristic of 1911. During the same period the domestic consumption of crude petroleum increased 28 per cent, from 419 million barrels in 1919 to 538 million barrels in 1920. This widening gap between production and consumption was made possible by a notable increase in imports from Mexico, which jumped from 53 million barrels in 1919 to 108 million barrels in 1920, thus slightly more than doubling. These relations are shown graphically in Fig. 1.

Such were the year to year changes. During the course of 1920 production speeded up markedly during the first quarter of the year, maintained a good pace during the second and third quarters, and slowed up during the last quarter in reaction to conditions of overproduction that became evident toward the close of the year. Stocks of crude petroleum in the country reflected this condition by increasing from 128 million barrels on Jan. 1, 1920, to 137 million barrels on Dec. 31, 1920. During the year, imports of crude petroleum displayed an accelerating rate of increase. These relationships are presented graphically in Fig. 2.

During 1920, also, the number of oil wells brought to completion in the United States totaled 33,678, an increase of 16 per cent over the 29,069 wells completed in the year preceding. The figures just given reflect the intensity of the drilling campaign that characterized most of the year. It may be noted in this connection that on Oct. 31 there were 258,600 producing oil wells in the United States, averaging 4.98 barrels of oil each per day. The ratio of new wells to producing wells is a significant figure, pointing to the growing cost of oil production.

Between Jan. 1 and Oct. 15, 1920, the refinery capacity

[1] Consulting engineer, New York.

[2] The 1920 totals given throughout this article are estimates based upon official figures for the first ten or eleven months of the year, to which are added graphically computed estimates for the remaining one or two months to complete the year. The totals given, therefore, will doubtless differ slightly from the official figures available in February or March, but the divergence will be of slight significance.

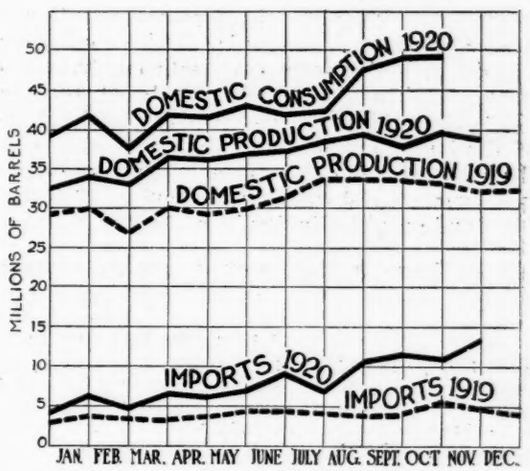


Fig. 2—Trend of the crude petroleum situation by months, 1919-1920

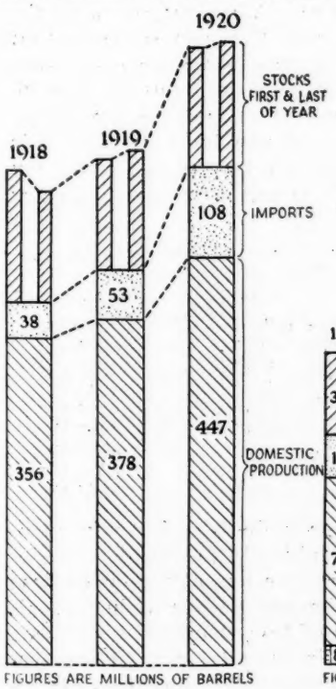


Fig. 1—Comparison of production, imports and stocks of crude petroleum in the United States, 1918, 1919, 1920

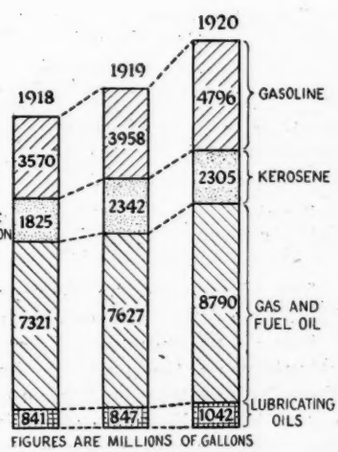


Fig. 3—Comparison of the production (of the major) petroleum products in the United States by years, 1918, 1919, 1920

of the United States, already in excess of the crude oil produced, increased approximately 27 per cent. Toward the close of the year the daily capacity of all the refineries in the country was 1946 thousand barrels, whereas the oils run daily to stills was only 1415 thousand barrels. Only about 73 per cent of the installed capacity was therefore being utilized in October, the month to which the figures just cited refer; and in November and December refinery activity notably fell off as a result of the seasonal decline superimposed upon the business depression. It is apparent, therefore, that the refineries of the United States are equipped in excess of market requirements, and many small refineries have in consequence ceased operations.

Petroleum Production

The principal petroleum products and those of interest to the automotive industry are, of course, gasoline, kerosene, fuel oil and lubricating oils. These four products, being made from the same raw material, have a joint relationship both as to quantity produced and market price. They should be looked upon in this light, therefore, if the true significance of their changes in status is to be grasped. A comparison of the production of these products in 1920 with their output in 1919 is given in Table I and graphically displayed in Fig. 3.

TABLE 1.—TREND OF PRODUCTION IN THE OIL INDUSTRY

	1918	1919	1920	Per cent change, 1918-1919	Per cent change, 1919-1920
Crude petroleum, mill. bbl.	356	378	447	+ 6%	+18%
Gasoline, mill. gal.	3570	3958	4796	+11%	+21%
Kerosene, mill. gal.	1825	2342	2305	+29%	— 2%
Gas and Fuel Oil, mill. gal.	7321	7627	8790	+ 4%	+15%
Lubricating Oils, mill. gal.	841	847	1042	+ 1%	+23%

The last two columns of the table are particularly informing, since they unmistakably reflect the effect of the

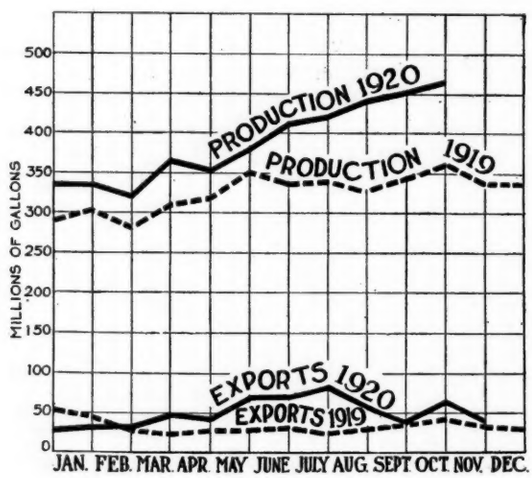


Fig. 4—Trend of the production and exports of gasoline by months, 1919-1920

automotive demand upon oil production. In 1919-1920 two products, gasoline and lubricating oil, entering into automotive transportation, increased more strongly than the domestic production of crude petroleum, whereas kerosene and fuel oil showed a smaller percentage increase than crude petroleum. With due qualification in mind, it is evident that a portion of the gasoline was made at the expense of kerosene and fuel oil, and a portion of the lubricating oils at the expense of fuel oil. This tendency, in spite of minor fluctuations and reversals, bids fair to continue with the expansion of automotive transportation.

Gasoline

The production of gasoline in the United States in 1920 attained the amazing total of 4796 million gallons, an increase of 838 million gallons over the 1919 output. The record production made in 1920 emphasizes the extent to which gasoline production was forced to meet the requirements of automotive transportation. Of the quantity produced in 1920, 618 million gallons, or 14.9 per cent, went abroad, leaving a domestic consumption of 4125 gallons, if the changes in stocks are taken into consideration. The trend of production and exports of gasoline during 1919 and 1920 is shown in Fig. 4.

The marked increase in output of gasoline, which ex-

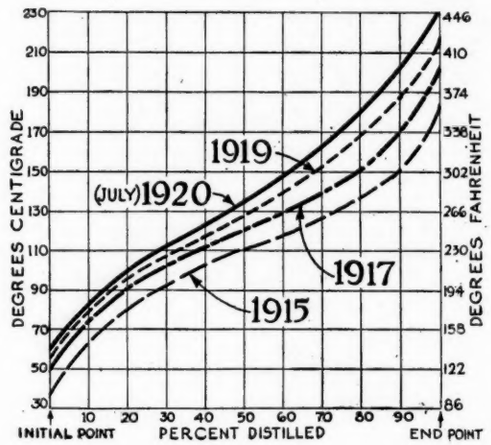


Fig. 5—Trend of the change in volatility of gasoline 1915-1920, showing the rise in endpoint. Data from U. S. Bureau of Mines

ceeded the expectations of many of the most sanguine, was not attained without effort. A comparison with the increase in kerosene output (see Table I) suggests that an increased quantity of the light kerosene ends went into the gasoline supply to augment its volume. The degree to which the gasoline supply of the country was supplemented in this manner is shown by a country-wide motor gasoline survey conducted by the U. S. Bureau of Mines, the results of which are summarized in the following table:

TABLE 2.—TREND OF THE ENDPOINT OF MOTOR GASOLINE
Data from U. S. Bureau of Mines

	Endpoint, April, 1919	Endpoint, January, 1920	Endpoint, July, 1920
New York	411° F	418° F	432° F
Washington	426° F	439° F	449° F
Pittsburgh	425° F	425° F	454° F
Chicago	423° F	445° F	455° F
New Orleans	435° F	424° F	445° F
Salt Lake City....	441° F	440° F	456° F
San Francisco	374° F	406° F	428° F
Average	417° F	427° F	456° F

The change in the average endpoint of motor gasoline since 1915 is shown graphically in Fig. 5.

The rising endpoint of gasoline has attracted endless attention on the part of the automotive industry, although the true significance of this change has not been altogether fully understood in all quarters. The gasoline requirements of the country and of the export trade have grown so rapidly that the supply of gasoline has kept pace only by virtue of a change in volatility so as to include a greater proportion of the crude petroleum. In spite of additions to the normal gasoline supply in the form of volatile gasoline won from natural gas, and

gasoline produced from gas oil by means of cracking methods of distillation, a shortage would have intervened had a highly volatile standard been maintained. As to the future, it is probable that the endpoint of gasoline will show fluctuations and even recessions for a time, although it is the belief of many that the continued growth of automotive transportation in the years ahead will force still further changes toward a heavier and less volatile motor fuel.

Kerosene is assuming a growing interest to the automotive industry because of its use in the heavy service internal combustion engine, although the bulk of the kerosene is still used for purposes of producing light and heat. During 1920 as compared with 1919, kerosene showed a decline in both production and exports, in this respect standing in a marked contrast to the other principal petroleum products. The output of kerosene fell from 2342 million gallons in 1919 to 2305 million gallons in 1920, while the exports declined from 979 million gallons to 842 million gallons during the same period. These recessions in the quantity of kerosene coming on the market in the face of a greatly increased refinery consumption of crude petroleum merely represent a complementary circumstance to the high endpoint of gasoline.

Gas and Fuel Oil

Fuel oil, and its lighter, more highly refined variety gas oil, constituted 52 per cent of the total output of the four major petroleum products in 1920, as compared with gasoline which represented 28 per cent of the total. It is obvious, therefore, that fuel oil is a liquid fuel reserve of almost double the magnitude of gasoline, and too much emphasis cannot be laid upon the importance of this product as potential motor-fuel, whether the transition is made through cracking, changes in the

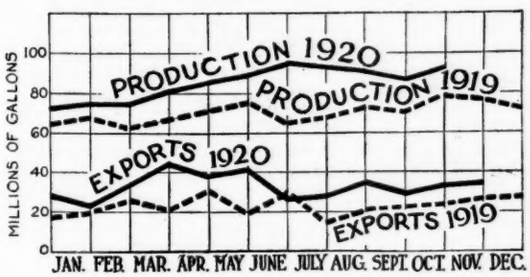


Fig. 6—Trend of the production and exports of lubricating oils by months, 1919-1920

automotive apparatus, or a combination of refinery and engine changes. The domestic output of gas and fuel oil increased from 7627 million gallons in 1919 to 8790 million gallons in 1920, an advance of 15 per cent. During the same period the exports of these products increased 35 per cent, or from 618 million gallons to 837 million gallons.

Toward the middle of the year a serious shortage of gas oil developed, because of its growing utilization for the manufacture of cracked gasoline. Considerable attention was directed to the prospective supply by the gas companies of the country, since gas oil is widely used for enriching, or carbureting, manufactured city gas. The upshot of the wide publicity given the matter was an increased appreciation of the close interrelationship existing between the joint products of petroleum, and of the far-reaching influence upon the oil industry arising from the requirements of automotive transportation.

The production of lubricating oils in 1920 attained the surprising total of 1042 million gallons, an advance of 23 per cent over the 847 million gallons turned out in 1919. At the same time, exports increased from 275 million gallons to 401 million gallons. With the changes in stocks figured in, domestic consumption of lubricating oils increased from 574 million gallons in 1919 to 623 million gallons in 1920, the increase being largely due to the increased demand for motor oils.

The trend of the production and exports of lubricating oils during 1919 and 1920 is shown graphically in Fig. 6.

During the year considerable attention was devoted to the problem of dilution, and the relation between high endpoint gasoline and thinned out crankcase oil was clearly apprehended. This point was actively discussed at the meeting of the American Petroleum Institute in Washington in November, when the problem was looked at jointly by both automotive and oil engineers. The recognition of dilution as a part of the fuel problem registers an important step forward in the handling of this issue.

Exports

Exports of petroleum products play an important rôle influencing domestic prices, a vigorous export demand serving to take up the slack between supply and domestic demand. A comparative view of the exports of the major petroleum products in 1914, 1919 and 1920 is accordingly shown in the subjoined table, the year 1914 being introduced to indicate the pre-war export requirements.

TABLE 3.—EXPORTS OF THE PRINCIPAL PETROLEUM PRODUCTS IN 1914, 1919 AND 1920

	Exports, mill. gals.			Per cent of production exported		
	1914	1919	1920	1914	1919	1920
Gasoline	210	372	618	14	9	13
Kerosene	1010	979	842	52	42	36
Gas and Fuel Oil	703	618	837	19	8	10
Lubricating Oils	192	275	401	37	32	38

It will be observed that kerosene and lubricating oils group together in the fact that between one-third and one-half of the domestic output is normally sent abroad, whereas gasoline and fuel oil show an export factor of between one-tenth and one-fifth.

The stocks of petroleum products in storage in this country carry an important market meaning as a barometer indicating the tension between supply and demand. A detailed account of the course of stocks would be a long story, but a general view may be obtained from Table 4, in which the stocks of gasoline, kerosene, fuel oil and lubricating oils on hand on Oct. 31, 1919, and Oct. 31, 1920, are expressed in terms of the number of days' supply represented by these quantities.

TABLE 4.—NUMBER OF DAYS' SUPPLY REPRESENTED BY STOCKS ON HAND OCT. 31, 1919, AND OCT. 31, 1920[a]

	October 31, 1919	October 31, 1920
Gasoline	34 days	23 days
Kerosene	51 days	63 days
Gas and Fuel Oil	40 days	34 days
Lubricating Oils	66 days	49 days

[a]Calculated by dividing the stocks on hand by the average monthly consumption for the year.

In a period of falling prices in which accumulation of stocks of many commodities were in evidence, it is important to note the relative decline of petroleum products in storage, kerosene being the only major petroleum product showing an advance over 1919, and that but a moderate advance. Further significance of these figures appears from a comparison with the average stocks of all commodities which have been estimated by the Chase

National Bank to have been approximately 41 per cent of the annual production on Feb. 1, 1920, or roughly 150 days' supply. It is, therefore, apparent that the working reserve of petroleum products in this country is less than half as great as the working reserve of commodities in general. In spite of these conditions, the stocks of the major petroleum products have been increasing slightly during the latter portion of the year, particularly since autumn, as a result of a combination of the normal seasonal slackening in demand combined with the results of the business depression. Such changes, however, are to be looked upon as temporary fluctuations rather than fundamental alterations.

Prices

The price situation showed some interesting developments in the year just past. During the first quarter of the year the price of crude petroleum advanced sharply, rising some 40 per cent between Jan. 1 and March 31. This sharp advance was accompanied by an analogous rise in the price of fuel oil and lubricating oils, and by a less precipitate but still a notable increase in gasoline and kerosene. The second quarter of the year saw further rises in the price level, which became more or less stabilized for the rest of the year for crude petroleum, gasoline, and kerosene, but broke into sharp declines for fuel oil and lubricating oils, the two last named products tending to follow the price decline of commodities in general.

This remarkable course of prices in the petroleum industry, which in part ran counter to price developments in general, may be shown effectively by index numbers with 1913 as a base. Table 5 shows the results of expressing the price changes in this manner.

TABLE 5.—THE COURSE OF PRICES IN THE PETROLEUM INDUSTRY
(Average prices for 1913 = 100)

	1913	1919	1920 1st Q.	1920 2nd Q.	1920 3rd Q.	1920 4th Q.
Crude Petroleum	100	197	270	311	314	311
Gasoline	100	142	154	169	176	179
Kerosene	100	162	202	213	226	226
Fuel Oil	100	147	233	288	286	226
Lubricating Oils	100	209	293	344	336	302
All Commodities[a].....	100	212	250	269	251	207

[a]U. S. Bureau of Labor Statistics.

The course of the average price of crude petroleum and its principal products is shown graphically by years in Fig. 7.

The price changes for a selected number of characteristic grades of petroleum products of interest to the automotive industry are shown in the table following:

TABLE 6.—CHANGES IN PRICE LEVEL OF SELECTED GRADES OF CRUDE PETROLEUM AND ITS PRODUCTS IN 1920

Grade	Quotation	Unit	Price, Jan. 1	Price, July 1	Price, Dec. 31
Penn. Crude..	At wells	Dols. p. bbl.	5.00	6.10	6.10
Kan.-Okla. Crude	" "	" " "	2.75	3.50	3.50
Gulf Crude (Humble) ..	" "	" " "	1.50	3.00	2.50
Gasoline, N. Y.	Tankwagon	Cents p. gal.	25.5	30.0	31.0
Gasoline, Chi..	"	" " "	21.0	26.0	26.5
Gasoline, K. C.	"	" " "	21.2	26.2	26.5
Kerosene, N. Y.	"	" " "	18.0	18.0	19.0
Kerosene, Chi..	"	" " "	15.5	18.5	18.5
Fuel Oil, Okla.	Refinery	Dols. p. bbl.	2.55	3.10	1.75
Lubs. Penn. Neutr. 200..	"	Cents p. gal.	27.0	35.0	22.5
Lubs. Okla. Neutr. 200..	"	" " "	17.6	27.3	21.8
Lubs. Penn. Cyl. Stk. 600.	"	" " "	33.5	48.5	26.0

The falling prices of fuel oil and lubricating oils during the latter portion of 1920, in the face of the maintenance of the price level for crude petroleum, seriously curtailed the margin of profit enjoyed by refineries in general and entirely wiped away this factor of safety in respect to many small refineries, especially the skimming plants in the south-central portion of the country. As a result of this circumstance and of complications growing out of the period of credit stringency through which the country has been passing, the mortality among refineries has been high in numbers. But, nevertheless, the refinery capacity of the United States is so over-expanded, and the country's petroleum products are so dominantly produced by refineries of 10,000 barrels daily capacity and above, that the rather wholesale closing of small refineries in certain sections of the country may not be expected to exert a far-reaching effect upon the productive capacity of the industry in the months ahead.

Summary

By way of summary, the outstanding features of the year were the following:

(1) The supply of crude petroleum, both from domestic and Mexican wells, increased surprisingly and led

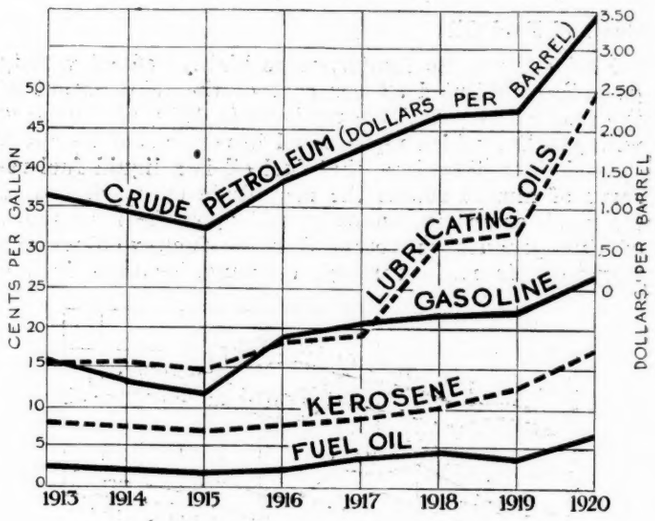


Fig. 7—Trend of the average price of crude petroleum and its principal products by years, 1913-1920

to conditions of moderate over-production toward the end of the year.

(2) The new production per well "brought in" in 1920 was less than in 1919, pointing to the necessity for intensive development if domestic production is to be maintained; toward the close of the year drilling operations were greatly curtailed.

(3) The supply of gasoline kept pace, but only with difficulty, with the greatly enlarged requirements of automotive transportation.

(4) The endpoint of gasoline notably increased during the year, this rise being accompanied by a lessened output of kerosene relative to the quantity of gasoline produced.

(5) A shortage of heavy-bodied lubricating oils developed during the early months of the year, which in turn led to greatly augmented production later on.

(6) Both crude petroleum and its principal products rose sharply in price to levels from which only fuel oil and lubricating oils partly receded.

(7) The oil industry was less affected by the period of industrial depression through which the country has been passing than most other activities, although a deferred effect has unmistakably been felt.

How the Automotive Industries Fared in 1920 Metal Market

Here you will find an explanation of the industrial statistics that have served only to confuse you during the last year. Also you will find statements of the use of metals in our industry and the prospects for 1921.

By William Crawford Hirsch*

A CURVE depicting the ups and downs of the iron, steel and non-ferrous metal markets in 1920 and one delineating the periods of prosperity and adversity in the automotive industries, would be as one egg is like another. The placing of this observation at the outset of this retrospect of metal market conditions in 1920, is prompted by the zeal with which statisticians, when the heyday of bloated values and fat premiums had vanished, sought to comfort the steel industry by stressing what they were pleased to call the minor importance of the automotive industries as a consuming outlet for iron and steel products. In the same breath in which they berated the automotive industries for having brought about the runaway steel market of the first half of 1920, they belittled the self same factor's importance as a buyer of steel by statistical legerdemain. The automotive industries consume only 2.6 per cent of the total steel ingot production. The automotive industries absorb only 3.5 per cent of the entire rolling mill output. These were some of the stones thrown into the steel industry's own garden. The deceptive character of these figures is all the more insidious because, standing by themselves, their inaccuracy is slight, while they are grossly misleading when employed to demonstrate the minor importance of the automotive industries in the steel market.

The measure of the automotive industries' support of the steel industry is **not one of tonnage but of dollars.** Conceding for the time being the correctness of the estimate that only 2.6 per cent of the steel ingot production went into automotive manufactures in 1920 (an estimate the shortcomings of which will become obvious later), the fact remains that the steel industry derived more gross and more net revenue in 1920 from the automotive industries than from any other source, not excluding the railroads. This is universally conceded by steel producers and very easily explained.

The automotive industries buy steel in highly finished form. The differential which automotive builders pay over ordinary black sheets for highly finished sheets, suitable for body, fender and radiator stock, is equivalent to the cost of two tons of rails for every three tons of such sheets. And this is only the differential over black sheets. When automobile sheets sold at record breaking prices last spring, a ton of this material represented a payment of approximately $350 to the rolling mill. At the same time railroads were paying $55 a ton for rails. Yet both rails and sheets are lumped as rolling mill products.

These preliminaries are merely intended to open the reader's eyes to the absurdity of a statement such as that the automotive industries consume only 3.5 per cent of the total rolling mill output. It would be just as logical to say that diamonds make up only a fraction of a per cent of the weight of the entire jewelry output.

Moreover, all these estimates are based on the weight of the steel in the finished automotive unit, multiplied by the number of such units reported to have been built in a given year. As a matter of fact, when the statement is made that the average passenger car contains 913 pounds of steel and 630 pounds of pig iron, the use of these figures as a basis to compute the amount of steel and iron purchased for the construction of this car is entirely unwarranted. The amount of scrap that results from cutting sheets to size and from machining cast or forged bars is so great that the tonnage purchased is far heavier than that represented in the finished product.

And what of the thousands of tons of steel that are absorbed by the machine tools and other equipment of automotive plants, to say nothing of tire, artificial leather and other accessory manufactories? To the steel statistician anything and everything that is tubular, is "oil country goods" wherefore he fails to credit automotive consumption with the thousands and thousands of tons of steel required to satisfy its needs in this direction. Because gasoline tanks and pumps are not part of the passenger car, truck or tractor, they have no place in his reckonings.

The course of events, however, has overtaken these statistical falsehoods and clearly established the undeniable fact that not only are the weal and woe of the iron, steel and non-ferrous metal markets indissolubly linked with the fortunes of the automotive industries but that, moreover, real, genuine prosperity in the former is predicated upon a like condition in the latter. Reviewing the trend of prices and conditions governing the markets for pig iron, steel products and non-ferrous metals in 1920, we find evidence after evidence of this. In fact, the year under review is divisible into two epochs, the first period coinciding with that of unalloyed prosperity in the automotive industries and the second marking a gradual transition from the prince to the pauper rôle. Tradition has it that the steel industry's repertory is made up of these two extreme parts and that it can play no other. If this is true, then it is condemned to play the part of the pauper until the automotive industries re-enter the stage as Lady Bountiful.

The year 1920 inherited from its predecessor a severe case of rich man's gout and this was aggravated by the utter disregard for price which those engaged in the automotive industries continued to display when it came to their quest for prompt deliveries of pig iron and steel products. It was nothing short of adding irony to insult

*Editor *Raw Materials.*

when those who were obtaining outrageously excessive prices for steel, pleaded that it was not their fault but must be charged to account of the automotive consumers, who were falling over one another in their mad scramble for supplies.

It was perfectly natural that automotive builders were anxious to maintain their production schedules and, when the railroad strikes began in April, they moved heaven and earth to obtain the necessary iron, steel, and non-ferrous metals for their operations. The transportation strikes furnished a blanket policy of insurance holding mills immune from liability for non-delivery of material contracted for. Much of this material, however, was turned out in spite of the scarcity of raw materials, and formed the sustenance of a premium market that soared and soared until its own top-heaviness caused its downfall.

The unnatural price levels established in this market together with the price schedule of the United States Steel Corporation, which remained unaltered throughout the year, and a somewhat higher range of values quoted by the representative "independents," constituted the tripartite price record that continued during the first half of the year. With the return of near-normal transportation conditions and a general awakening to the dangers of inflation, the premium market vanished and there remained the dual price condition of the Corporation and the representative "independents." This state of affairs persisted until October brought the first signs of a let-up in demand from the automotive industries and from then until the end of the year was consumed in a gradual wiping out of all differences in prices between the Corporation and "independents," with the result that the end of the year witnessed a virtually once more uniform price schedule, that of the Corporation.

A very modest estimate of the amount which the "independent" steel mills received in 1920 in excess of what they would have received, had they sold their output at the same price as the Corporation, is $250,000,000 to $350,000,000. When there is added to this the amount that was "cleaned up" by intermediaries in the form of premiums on top of premiums during the "famine" period, the amount paid by consumers for the output of the "independent" mills in excess of the Corporation's prices, may be put down as having been very close to $500,000,000. It is left to the reader's recollection of the days when it was nothing unusual to bring a "load" of steel in a Pullman compartment from Youngstown or Pittsburgh to Detroit, to estimate how much of this bill was defrayed by the automotive industries.

Course of the Pig Iron Market

With the exception of 1917, the present generation has not witnessed pig iron prices of the magnitude recorded last year. In a large measure blast furnace interests ascribe these phenomenal prices to the corresponding condition in the coke market in which July witnessed quotations of $18 for furnace coke, f. o. b. Connellsville ovens. This compares with an average price of approximately $1.75 in 1914. Aside from this influence and undoubtedly generally enhanced production costs resulting from increased freight rates, there was in evidence, however, a disposition on the part of some of the pig iron interests to force the establishment of a $50 pig iron market and to "hold it there." Foundry iron which had started the year at $38.50, valley furnace, gradually went higher and higher until in September $50 became a nominal quotation for at least a brief spell. When pig iron sellers sought to make this an actual instead of merely nominal quotation, consumers, especially automotive foundries, balked and the first of the "consumers' strikes" which have since then become fashionable, ensued. Certain pig iron interests excoriated those who dared to question the justice of and the justification for a $50 market and predicted "much higher price levels." At the close of the year, however, after 215 out of a total of 416 furnaces had gone out of blast, the price for No. 2 foundry was down to $33 and sellers were hunting in vain for buyers.

The year 1920 marked the entry into the ranks of pig iron producers of one of the large automotive interests. Reports that this factor was offering iron of his own manufacture, at prices below the general market, served to hasten the return to saner values. When the market approached the $50 level, quite a number of automotive foundries that were holding contracts for the delivery of pig iron at below $40, turned resellers.

The two grades which are chiefly used in automotive foundries established the following price record, which is compared with that of 1913, the last normal pre-war year.

Pig Iron Prices in 1913 and 1920

	Foundry No. 2 (Valley Furnace)		Malleable (Chicago)	
	1913	1920	1913	1920
January	$17.50	$38.50	$18.00	$40.50
February	17.00	41.00	17.25	42.75
March	16.50	42.00	17.25	43.50
April	15.50	42.50	17.00	43.50
May	14.75	44.00	16.00	43.50
June	14.25	45.00	15.75	43.50
July	14.00	45.00	14.75	45.25
August	14.00	47.75	15.00	46.50
September	14.00	50.00	15.00	46.50
October	14.00	46.75	15.25	46.00
November	13.50	40.75	14.75	42.00
December	13.50	33.50	14.50	33.00

History of Semi-finished Steel

From the point of view of the automotive industry, sheet bars in 1920 were more than ever the key commodity of the semi-finished steel market. This product represents the intermediate stage between the raw steel and the finished sheet and for this reason is always of greatest importance as a market criterion. But in 1920 the sheet bar assumed double importance to the large automotive interests for the simple reason that they not merely had to keep their eyes on the sheet bar market but actually were compelled to go on periodical sheet bar hunts. In the first half of the year it became almost a custom for passenger car builders to buy sheet bars from the bar rolling mills and furnish them for conversion to the sheet mills. Under normal conditions even the smallest of the sheet rolling mills were accustomed to buying their own sheet bars and selling the finished automobile sheets, making a legitimate profit not only on their conversion but also on the raw material. When the location of sheet bar tonnages obtainable at anywhere near reasonable prices became, however, a task that tried the most resourceful, these sheet manufacturers threw up the sponge and told the automotive purchasing agents that, if they wanted sheets, it was up to them to provide the bars. The latter, urged on by their production managers, lost sight completely of the United States Steel Corporation's sheet bar price of $42 and went out to get the material at any figure, with the result that many a sale of sizable tonnage was reported in June at $90 and, in a few isolated instances, sales at higher than $100 were reported to have been made. The following table of prices in 1920, compared with those in 1913, does not record these absurdly high levels which were paid in the form of a premium over the quoted market price; yet comparison with the levels that pre-

vailed in the last pre-war year, tells the story of the price orgy eloquently:

Prices of Open-Hearth Sheet Bars, Pittsburgh

	1913	1920
January	$29.25	$50.00
February	30.00	67.00
March	30.00	75.00
April	28.25	72.50
May	27.50	72.50
June	27.00	75.00
July	27.50	72.50
August	26.25	70.00
September	25.00	66.00
October	23.00	65.00
November	21.50	50.00
December	21.00	47.00

The story of sheet bars was typical of all forms of semi-finished steel, so that we may proceed to a consideration of the movement in the finished steel market.

Finished Steel Products

If automotive consumers paid swollen prices for sheet bars in 1920, they paid nothing short of a king's ransom for such automobile sheets as were obtainable in the finished state either from rolling mills or resellers. Reference has previously been made to the startling levels that were obtained for highly finished sheets but there was a brief period in mid-summer, when even ordinary No. 28 black sheets for early delivery were sought at as high as 15 cents.

According to *The Iron Age*, the total sheet production in 1920, exclusive of tin and terne plate, amounted to 2,600,000 gross tons. Of this tonnage, 85 per cent, or 2,200,000 tons, were sheets of 13 gage and thinner. Any one who followed the character of the buying last spring and summer, will concede that virtually all of the latter sheet went into passenger cars and of the 400,000 tons of sheets, 12 gage and thicker, the bulk undoubtedly was used for frames.

That the automotive industries consumed last year 2,000,000 tons of sheets, is a very conservative estimate. This is the equivalent of 4,480,000,000 pounds. At an assumed average price of 6½c. (which, in view of the price record, is very modest), this tonnage would represent an approximate outlay of close to $300,000,000, which, in itself, disposes of the absurd misstatements that the automotive industries constitute a small factor in the steel market.

The following table, contrasting 1913 with 1920 prices for No. 28 black sheets, does not record the startling premiums that obtained in the late spring and mid-summer:

No. 28 Black Sheets, Pittsburgh

	1913	1920
January	2.30	5.00
February	2.35	6.00
March	2.35	6.00
April	2.35	6.00
May	2.35	7.00
June	2.30	7.00
July	2.25	7.00
August	2.20	7.00
September	2.10	7.00
October	2.05	7.00
November	2.00	6.00
December	1.85	4.45

To cite the price records of other finished steel bought by the automotive industries, such as cold-rolled strip steel or of bolts and nuts, would be merely duplicating the performance of sheets. Up to the latter part of July, when the first indication of a slowing up in automotive cast its shadows before, any price was fair from the sellers' point of view. This was followed by a period of grim determination on the part of the independent producers to maintain the differentials which they had established over the Corporation's levels, but, in October, it became discernible to all that it was no longer possible to maintain these quotations even as purely nominal and, amid utter idleness, prices gradually shed their obesity.

Alloy Steels

The alloy steel industry, as constituted to-day, is really a creation of the automotive industries and utterly dependent upon the latter not merely for its partial support but for its very continuance. As the result of their serviceability in the making of axles, connecting rods, crankshafts, gears, steering knuckles, high tensile bolts and a variety of smaller parts, either forged or machined from hot- or cold-rolled or drawn bars, nickel-chromium steels came to the front in 1920. On the other hand, there appears to have been some diminishment in the use of vanadium in automobile steels. Metallurgical progress centered around the electric furnace and heat treatment methods and, while a number of complex ferroalloys were put on the market, none of these found practical employment in the automotive industries.

Prices for special alloy steels are and will always remain a matter of individual arrangement between sellers and consumers. They are specialties of varying analyses and into their cost enters, to some extent at least, the steel maker's reputation for metallurgical skill and accuracy. What happened in the alloy steel market last year may, however, be fairly judged by the price movement of ferromanganese which still remains the key alloy.

Ferromanganese Prices

	1913	1920
January	$68	$146
February	65	172
March	65	216
April	61	240
May	61	250
June	61	225
July	59	225
August	56	198
September	56	170
October	50	170
November	50	170
December	47	135

Non-ferrous Metals

Viewed in the retrospect, the year 1920 was one of orderly deflation in the non-ferrous metal markets. The writer of this review considers himself fortunate that he was not called upon to prepare this article last December when, under the spell of the wave of pessimism that prevailed at that time, annual résumés of the non-ferrous metal markets took on a much darker hue than appears warranted. The non-ferrous metal business is, far more so than the steel business, one of short-time financing and, whenever money becomes as tight as it did in the closing months of the year, forced liquidation is bound to give the market a funereal appearance. Then follows a calm survey of the statistical position and the invariable result is that the old law of supply and demand has once more worked for the best. Before considering the record of the market's key metal, copper, the 1920 history of aluminum may be briefly summarized because of the commanding position of the latter from the point of view of the automotive industries.

Aluminum's History in 1920

The year opened with the sun shining brightly in the automotive field and for several months the sole domestic producer could not satisfy the demand, although

working at full capacity. Here and there, odd lots of imported metal bobbed up but, up to the middle of July, the 32.75 cents price for No. 1 virgin ingots, 98 to 99 per cent pure, of the Aluminum Company of America was to all intents and purposes the market, the importers refusing to shade this price level more than a fraction of a cent, so long as it was clearly evident that the demand exceeded the supply. Fastidious automotive consumers hesitated, when foreign metal was offered to them at concessions from the domestic level. Some of the importations consisted of mixed lots that might and might not come up to analysis. The American interest announced an advance to 33 cents at the very time when the first signs of a slackening in the demand made themselves felt and then a veritable avalanche of imported aluminum began to inundate our shores. Not only England and France shipped metal and sheets here but Norway, Germany and other countries figured as sellers. Judging from some of the aluminum offers received from Germany, that country must have an even more plentiful supply of bauxite (the mineral from which aluminum is extracted) than of paper marks. Lower and lower went prices in the "outside" market until at the end of the year the metal was offered freely at 25 cents. Meanwhile, the American producer had instituted a spot price for immediate deliveries, several cents higher than the "outside" market but considerably below his contract price which was maintained intact for strategic reasons.

Imports of aluminum and aluminum manufactures in 1920 probably amounted to around $14,000,000, compared with about $9,000,000 in 1913 and $12,000,000 in 1919. The American producer is asking for the restoration of a duty of 7 cents a pound. In this, he is opposed by the consuming interests. Meanwhile, a new octopus has been born in the European aluminum industry, the Compagnie d'Alais which, after absorbing the Société Electrometallurgique Français, controls 90 per cent of the aluminum producing capacity of France, besides the works in Norway and a controlling interest in the Italian aluminum works.

The price record of aluminum, compared with that of 1913, is given here for the "outside" market:

Aluminum Prices for No. 1 Virgin Ingots, 98 to 99% Pure
(Outside Market)

	1913	1920
January	26	32
February	26	32
March	27	31½
April	27	31⅝
May	26	32
June	25	32
July	23½	32
August	22¾	32¼
September	22	35
October	20¼	29
November	19½	27¾
December	18¾	24

Copper's Eventful Course

The year 1920 inherited from its predecessor a surplus of refined and blister copper of 941,000,000 pounds and bequeathed to its successor a surplus of 874,000,000 pounds. These figures really tell the story of the movement in the red metal in a nutshell. The load inherited from 1919 was too heavy a burden and, as a result, the 19 cents price level at which electrolytic opened the year, sagged and sagged until at the close of December buyers at 13½ cents were as scarce as hens' teeth. Producers had recourse to every possible device to stem the downward course which did not become precipitate until October. They lowered refinery production from approximately 1,750,000,000 pounds in 1919 to 1,575,000,000 pounds in 1920. Ever so often the spokesmen of the copper industry would give out interviews that the demand from Europe for copper had at last set in and that it would not be long before England, France and Italy would literally eat up the surplus and, if they left any of the red metal over, Germany would lick the platter clean. But custom house returns failed to substantiate these predictions and exports showed only a slight improvement over 1919, much of the metal going abroad being strongly suspected of being shipped on consignment.

From the standpoint of the automotive consumer of copper, the most interesting development of the year was the activity of a research committee appointed by the copper producers to investigate the causes underlying the ailing copper market. This committee made the following report regarding copper consumption by the automotive industries:

> In no one industry has public ignorance of the merits of copper and brass been more costly than in automobiles. Since the first year of the war there has been a steady tendency toward iron products until the total amount of copper and brass now used in the average automobile is about 36 pounds. To this substitution in structural and working parts is attributed the tremendous increase in the automobile repair business in the last few years. The breaking down of cars turned out in the last five years is particularly noticeable in coast cities where salt air affects machinery not immune to rust. A notable exception to this war-time and post-war substitution is a certain large passenger car which the A. E. F. made famous in Europe. It contains 200 pounds of copper in striking contrast to another large and high-priced car that contains 30 pounds.

This is not the place to make suitable answer to these *ex-parte* statements which must be replied to in terms of tensile strength, elongation and specific gravity of the high grade alloy steels to which the copper committee refers as "iron products." Coming out of the mouths of the copper producers themselves, however, the fact may be put down that there has been a falling off in the consumption of copper in the unalloyed state in the automotive industries. That the tonnages of copper consumed in brass parts that enter into automobile manufacture is considerably greater than generally supposed, is certain. The statement recently made that the automotive industries consume approximately 75,000,000 pounds of brass a year or around 7 per cent of the total output, is based on altogether false premises. It takes no account, whatsoever, of the very large output of automotive castings, screw machine products, etc., that are made from secondary metal or so-called ingot metal which the foundries purchase from secondary refiners. A clear picture of the course of values in 1920 may be gained by means of the following table comparing 1920 prices with those of 1913.

Price for Electrolytic Copper, New York

	1913	1920
January	16¾	19
February	15¼	18⅝
March	15	18⅜
April	15½	18½
May	15⅝	18¼
June	14⅞	18
July	14½	18⅝
August	15⅝	18½
September	16½	18
October	16½	16¼
November	15½	14⅜
December	14½	13½

Highlights in the Tin Market

Tin is of chief interest to the automotive industries because it enters into solder and babbitt, although it is also used for the plating of radiator parts and, with copper and zinc, forms an essential constituent of bronze. The outstanding feature of the market was the tremendous accumulation of white metal alloys, such as babbitt and solder, which, when the slump came in October, were a drug on the market. The chief influences in the tin market were the kaleidoscopic changes in the value of the pound sterling, speculation both in London as well as here, and a paternal interest on the part of the Federated Malay States Government in the welfare of the Straits Settlement tin producers which led to the adoption of a quasi-valorization scheme that sooner or later must lead to disaster. Compared with 1913, the course of values was as follows:

Straits Tin, New York

	1913	1920
January	50	63
February	49	60
March	47	62
April	49	62
May	49	55
June	44	49
July	40	49
August	42	48
September	42	45
October	40	41
November	40	37
December	38	34

Ups and Downs in Lead Market

Because of the predominant use of lead in storage batteries and other automotive parts, the market for this metal was a true replica of the tide and ebb in the automotive industry. As a lead consumer, the latter is exceeded only by the paint industry. At one time there were heavy importations of foreign metal, the differential between the relatively high New York and the relatively low London market making such operations profitable for a brief spell. The entire domestic output was 525,000 short tons compared with 517,000 tons in the preceding year. Compared with 1913, the price movement was as follows:

Monthly Average Lead Prices, New York

(Am. Smelting & Refining Co.)

	1913	1920
January	4.35	8.32
February	4.35	8.75
March	4.35	9.21
April	4.40	9.25
May	4.36	8.65
June	4.35	8.24
July	4.37	8.20
August	4.63	8.83
September	4.75	8.52
October	4.45	7.47
November	4.34	6.61
December	4.06	4.94

Zinc Prices in Slow Descent

Zinc did not fare very much different from lead in 1920. The market's undertone, however, was always decidedly weak because of a considerable surplus which is an old sore in the zinc industry and which is no nearer to elimination now than it was two years ago. In spite of this millstone around the producer's neck, there were large importations during the year as the result of cheap offerings from Belgium and Germany in London. As will be seen from the following table, the market at the end of the year was very close to the levels of the pre-war period:

Prime Western Zinc, East St. Louis

	1913	1920
January	7	9¼
February	6¼	8¾
March	6	8⅝
April	5½	8¼
May	5¼	7¾
June	5	7½
July	5¼	7⅞
August	5⅝	8
September	5⅝	7¾
October	5¼	7¼
November	5⅛	6⅜
December	5	5⅞

Sundries of Metal Market

Nickel, which is used by one of the large battery producers, and also enters heavily into the manufacture of automotive steels as well as into plating of certain parts, remained virtually unchanged in price. Production has been lowered sharply so as to correspond with the diminished demand. Deputy Minister Thomas W. Gibson of the Ontario Department of Mines, referring to the expanded capacity of the nickel producing companies as one of the war's results, says that now "they feel all dressed up, but nowhere to go."

The antimony market moved from 10½ cents at the opening of the year to 5½ cents at the end, with the high at 11½ cents in February. The untoward exchange situation injured the Chinese producers more than the gradual deflation of values of which they had their first taste early in the year, when the business collapse in Japan put commercial and industrial affairs in the Orient at sixes and sevens.

The Outlook for 1921

The foregoing record of 1920 in the iron, steel and non-ferrous metal markets, together with such observations of the course of values which the interval since the beginning of the new year has permitted, afford a fairly definite basis on which to rear a sound purchasing program for 1921. While detached consideration of the price tables comparing 1913 prices with those of 1920, may in the case of pig iron and steel products lead to the conclusion that the spread between the levels which prevailed before the cataclysm of the world war, and those which marked the close of last year, is still too great, it will be well to remember that virtually all economists are agreed that there will be no complete return to pre-war commodity prices in our generation.

Further price adjustment is likely to be devoid of the spectacular and relatively slow. In many of the non-ferrous metals, values have declined to levels out of gear with the general run of basic commodities. Anticipation of reasonable wants appears to be justified, if for no other reason than that further postponement of buying is certain to lead to the accumulation of a large suppressed demand which, when it does make itself felt, can have but one result, i.e., to bring about an upward reaction in prices which would still longer delay the orderly process of a return to normal. Nothing is to be gained by a further drying up of the sources of supply. In spite of the ill-thought vaporings of this or that figure-juggling detractor of the importance of the automotive industries as a consumer of iron, steel and non-ferrous metals, the fact remains that to no other factor do the producers of these commodities look so much to make the smoke belch forth from their blast furnaces, smelteries, refineries, foundries and rolling mills than to full revival of automotive production and activity.

Present Status of German Automobile Industry

This article describes the engineering, social, and economic aspects of the German automobile industry at the present time. It points out the general tendencies in design and production and indicates the handicaps which are being encountered. 43 factories producing cars or trucks.

By Benno R. Dierfeld

THERE are at present 43 automobile factories in Germany, 14 of them building passenger cars and trucks, 20 of them producing only passenger cars and 9 factories building only motor trucks. The 34 works building passenger cars produce about 90 different models as listed in the following table:

10	car	types	below	16	brake	hp.
10	"	"	of	16	"	"
13	"	"	up to	22	"	"
15	"	"	" "	30	"	"
5	"	"	" "	35	"	"
7	"	"	" "	40	"	"
11	"	"	" "	45	"	"
16	"	"	" "	55-80	"	"

The table shows that cars of 22 to 30 brake hp. are very frequently built and that a large part of the German manufacturers obviously believe these car sizes to be most suitable for the German customers. On the other hand almost as many cars have engines of 45 brake hp. or larger, representing an opposite opinion of some of the larger factories. Thirteen works build a single model, 8 firms build 2 models, 6 firms 3 models each, and only 7 factories build more than 3 models. The stroke to bore ratio is very different and varies between 1.3 and 1.6; a united opinion about the most favorable ratio still does not seem to be existing at present, for different car types, built by one firm, show different stroke to bore ratio. The design of the German passenger cars does not differ materially from the outlines given in my article, "The German Passenger Car Industry After the War" (AUTOMOTIVE INDUSTRIES, May 27, 1920). The disk clutch is only used by five works and only one car has left-hand drive. Of course electric starting and lighting systems are applied to many cars, but the car prices then are very high. No important change can be found in the German passenger car market up to the present moment, but a car of revolutionary design now is completing its test runs and surely will cause a sensation when the first details are published; cycle cars, of course, show many innovations. The selling prices of passenger cars are not materially lower.

The 23 factories producing motor trucks build 51 truck types with the following engine powers:

4	truck	types	of	25	brake	hp.
2	"	"	"	28	"	"
5	"	"	"	30	"	"
7	"	"	"	35	"	"
2	"	"	"	38	"	"
4	"	"	"	40	"	"
5	"	"	"	42	"	"
9	"	"	"	45	"	"
8	truck	types	of	50	brake	hp.
2	"	"	"	55	"	"
2	"	"	"	60	"	"
1	"	"	"	86	"	"

An engine power of 30 to 50 hp. seems to be most suitable for the use of German customers. Eight firms only build 1 truck type, 5 firms 2 types, 4 firms 3 types, 4 firms 4 types and 1 firm 5 types. The stroke to bore ratio varies from 1.3 to 1.6, the number of revolutions from 800 to 1500 per min. Almost all cylinders have non-detachable L or T-head and the cooling is effected by pumps. Only 4 types have thermo-siphon cooling and 1 type air cooling. Pump lubrication and magneto ignition are always used. Clutches are in most cases of the simple cone design, only 1 type using double cone clutches and 7 types disk clutches running in oil. Almost all transmissions are of usual design and have four speeds and reverse, only 3 types having a 3-speed transmission; the rear axle drive is effected on 30 types by cardan shaft and bevel gears, on 20 types by two side chains, on 1 type by internal gear. One brake is arranged on the transmission and operated by pedal, the others are in the two rear wheels and operated by hand lever; the springs invariably are half elliptic and have in some cases small auxiliary springs. The steering post is located at the right side. The cast steel wheels have single plain rubber tires at the front and twin plain tires at the rear. Pneumatic tires for trucks are unknown in Germany. The loading capacity of the trucks varies from 1 to 5 tons and their speed from 15 to 60 kilometres (9.3 to 37 miles) per hour.

The economic or commercial situation of the German automobile industry is materially influenced by the exchange rate of the German mark; if the value of the mark advances the German works cannot export, for the German automobile prices are high on account of the high wages and the increasing costs of raw materials. Therefore, during the summer and autumn of 1920 a stoppage of the German automobile export occurred and the consequence was an increased supply for the home market. Dealers who formerly were very glad to receive any cars at all, were overwhelmed with car offers by the manufacturers. Sales on the home market were few. Not only has the customer's ability or inclination to buy gradually diminished, but also the customer calculated that automobile prices would drop as a result of overproduction. When old orders have been filled the only new market for trade will be the export to foreign countries. Therefore the German automobile industry wishes the annulment of the export duties, an

antiquated institution established at a time when the world market price was considerably higher than the home price, and with the purpose for preventing a clearance sale of German automobiles.

At present the value of the German mark has dropped home price, and with the purpose of preventing a clearance sale of German automobiles.

As it is impossible to import motor vehicles into Germany on account of the unfavorable exchange rate and other restrictions, some prominent American firms have successfully tried to gain a solid footing in Germany, not only on account of the German market, but also because Germany serves as a base to the large Russian market and to the other northern, eastern and southern countries. One year ago the International Harvester Co. founded at Bremen a branch and at Berlin another branch with workshops. Somewhat later the German automotive industry was alarmed by the announcement that almost 50 per cent of the shares of the prominent Caoutchouc and Guttapercha Co. at Hannover, producers of the famous Continental tires, had passed into the hands of the American Goodrich Rubber Co. Thus the American company takes advantage of the low wages in Germany (as compared with foreign wages and reference to the exchange rate of the mark), difficulties with importing the raw material are avoided and the customers buy really German built tires.

Ford Tractor to Be Produced in Germany

The American Ford Company has recently bought the Berlin factory of Ehrich and Graetz, which formerly produced lamps and during the war shell igniters, etc. At present this Berlin firm has sued for permission to import 2 trucks, 2 passenger cars and 8 sample Ford tractors, so that the German Government, farmers, etc., may be convinced of the suitability of these vehicles for German working conditions. The complete engines will be imported from America, while the other parts of the tractor will be manufactured in Germany by other German manufacturers according to the instructions of Ford.

The Ford tractor produced in Germany will be sold at 20,000 marks, if the production reaches 100 tractors a day. In the beginning, however, only 10 to 20 tractors per day will be produced and the selling price, of course, will be higher.

Later on the manufacturing of the Ford cars and trucks will be taken up; the German Ford works will provide with tractors and cars not only Germany but also the other European countries. All capital brought into Germany by the Ford company remains in the country, as does the profit arising from the enterprise. The Ford Co. also is liable to pay taxes to the German Government. Such enterprises only can be successful if the peculiar German conditions are carefully taken into account and if the factories selected for manufacturing really answer this purpose.

CAPITAL STOCK OF GERMAN MANUFACTURERS

Name of company	1914–15 marks	March, 1920 marks
Daimler Co. (Mercedes cars)	8,000,000	68,000,000
Adler Co.	13,000,000	36,000,000
Benz Co.	22,000,000	33,000,000
Hansa-Lloyd Co.	10,000,000	32,000,000
N. A. G. Co.	7,000,000	20,000,000
Wanderer Co.	3,500,000	10,500,000
Vomag Co.	5,250,000	10,000,000
Magirus Co.	2,000,000	9,000,000
Deutsche Lastautomobile Co.	1,000,000	8,000,000
Dux-Automobile Co.	1,500,000	7,000,000
Fahrzeugfabrik Eisenach (Dixi cars)	3,000,000	4,500,000
Duerkopp Co.	4,500,000	4,500,000
Presto Co.	1,500,000	4,000,000
Horch Co.	3,000,000	3,300,000
Mannesmann-Mulag Co.	2,000,000	3,000,000
Loeb Co.	2,000,000	2,500,000
Apollo Co.	1,000,000	2,300,000
Elite Co.	400,000	2,000,000

The gigantic growth of the American automobile industry raises the question as to whether the German automobile industry can remain capable of competition for the world's market, in the face of comparatively high German wages and the necessity to buy foreign raw materials at the low exchange rate of the mark.

The first and principal measure of the German industry in this respect is financial preparations for the future competition, i.e., the issue of new shares. The extent of this financial preparation may be seen from the accompanying table, representing a comparison between the share capitals of 1914-15 and the middle of March, 1920. This table is reprinted as a matter of reference.

Some of these figures have since been increased again and notice of new issues published, so that the real augmentation of the capital of the German automobile industry since 1915 may be estimated at about 215 million marks.

American Invasion Feared

The fear of the American invasion is indeed the chief reason for the financial preparation, mentioned above, and for the same reason three large German factories have formed a union with the name "Gemeinschaft Deutscher Automobilfabriken" abbreviated "G. D. A." and four smaller factories formed another union "Deutscher Automobil Konzern," abbreviated "D. A. K.," with the purpose of standardizing their designs and cheapening their production.

As the whole capital invested in the German automobile industry is not even as great as the capital of some few large American factories, it cannot hope to reach the giant American production figures and the cheap selling prices of some American cars. Therefore the only course for the larger part of the German automobile industry seems to be the production of "quality" automobiles that cannot be beaten on the world's market.

The social situation has produced very severe working conditions for the German automobile industry. Every factory must have a so-called "Betriebsrat" (factory-soviet), that is elected by the workmen representing employees and according to the law has the following duties:

The factory soviet is bound to assist the manager in his duties, to advance the performances of the workmen and the production of the factory, to further the agreement with the workmen and between workmen and manager. But in practice the factory soviets have frequently caused impossible situations from the manufacturing and financial viewpoints.

German Dealers Have Their Troubles

The situation of the German automobile dealer is rather difficult at present. While after the war the importance of the automobile increased owing to service difficulties of the railways, the automobile industry could not answer the heavy demands, because its capacity of production was decreased by very different factors: eight-hour working day, diminishing of working inclination and working intensity, numberless strikes, checking influence of the factory soviets and last but not least the coal scarcity. Therefore, the manufacturing costs were advanced to an unprecedented level, whereas the production dropped as to quantity and frequently also as to quality.

(*Continued on page* 421)

The Trend of Airplane Design

(*Continued from page* 364)

senger—that seems to have merit. This plane carries one person, handles exceptionally well and is economical. It is a biplane, powered with a three-cylinder Lawrence air-cooled engine of 60 horsepower.

Commercial Carriers.—There has been several interesting commercial land planes developed that give promise of more extensive utilization during the coming year. Among these are the Martin and the Lamson.

As predicted, however, seaplane commercial carrier development has been extensive. The Aeromarine Plane and Motor Co. are at present the prime movers in the field and have done meritorious pioneer work in converting Navy F59 and H52 L seaplanes into commercial ships. These planes are well adapted to commercial work, and will doubtless form the basis of redesigned carriers when the supply from the Navy is used up.

Miscellaneous Developments.—Considerable work has been done along the line of investigating possibilities of high speeds at high altitudes by means of engine superchargers. The present conclusion is that superchargers will be advantageous on fighting planes, where high altitudes and high speeds are a prime essential. For commercial carriers it is not believed that superchargers will come into any extensive use.

Few new engines have appeared, chiefly because there has been no great demand. Packard has developed several standard designs of merit, and the designers of the Lawrance 3-cylinder radial air-cooled engine are bringing out a 9-cylinder engine of similar construction and greater horsepower. This latter type possesses several points of great merit, and it is believed a very satisfactory plane will be produced around it.

The Army has been experimenting with variable pitch and reversible propellers. These are advantageous in securing maximum efficiency, and will decrease the landing run. These reversible and variable pitch propellors are an important development and if mechanical problems are solved will do much to advance aviation.

Many experiments are being conducted on parachutes; and out of them satisfactory and safe types are being produced. It is believed that airplanes will eventually be designed so that all occupants have parachutes; and a means of ready egress from the plane in case of necessity. Considerable educational and development work will be required, however, to bring this condition about.

Fireproofing.—Airplane fabrics previously were always inflammable. This was reduced somewhat by nitrate dopes. During the past year, however, methods of fireproofing airplane covering have been developed; and these have been shown by test to reduce the fire hazard. Gasoline, of course, is the greatest point of danger; and the hazard here can be reduced, and is being reduced by use of leak proof tanks. The future airplane will be nearly fireproof, and will carry its fuel supply either in leak proof tanks or in such a manner that it can be dropped from the ship in time of fire.

As will be noted from the preceding, airplane development is proceeding as well as can be expected under existing conditions. Government contracts are serving as the basis of the business, and manufacturers are alive to every business opportunity and carrying-on as well as circumstances merit. That the development is not up to the wild hopes of the armistice period is logical—that it will be, certain.

Specifications of American Aircraft Engines—1920-21

(Compiled for Automotive Industries by Arch. & Don R. Black)

Name and Model	CYLINDER DATA				Piston Displ., Cu. Ins.	RATING		Reduction Gear Ratio	Approx. Gals. Gas per Hour	CONSUMPTION PER B.H.P. HR. IN LBS.			WEIGHT IN LBS.			Brake M.E.P. Lbs. Sq. In.	Compression Ratio	Carburetor	Ignition	INSTALLATION DIMENSIONS IN INCHES				
	No.	Arrgt.	Bore	Stroke		B.H.P.	Crank R.P.M.			Gas	Oil	Total	Dry Eng.	Jacket Water	Total					Overall Length	Overall Height	Overall Width	Height Above Eng. Bed	Center to Center of Beds
Aeromarine.....B	8	V-45°...	3⅝"	5⅛°	423	150	2275	1.75	13.0	.492	.04	.532	420	26	446	121.0	5.125	Z.....	D.....	49⅛	36⅞	22¾	21	13½
Aeromarine..L-6-D	6	Vert....	4¼"	6½"	553	130	1625	Dir....	10.6	.51	.03	.54	442	.....	.....	114.0*	5.25*	Z.....	D.....	59²¹/₃₂	36²⁹/₃₂	16	24²⁹/₃₂	14
Aeromarine..L-8-D	8	V-60°...	4¼"	6½"	738	170	1600	Dir....	13.4	.49	.03	.52	500	.....	.....	113.0*	5.25*	Z.....	D.....	49⅛	34¼	32⅝	22¼	13³²/₃₂
Aeromarine....U-6	6	Vert....	4¼"	6½"	553	130	1750	Dir....	11.0	.53	.03	.56	375	27	402	117.6	5.32	Z.....	D.....	57¹¹/₃₂	36²⁹/₃₂	16	24²⁹/₃₂	14
Aeromarine....U-8	8	V-60°...	4¼"	6½"	737	180	1750	Dir....	13.6	.472	.011	.483	531	36	567	117.6	5.32	Z.....	Di.....	49⅛	34¼	32⅝	22¼	13³²/₃₂
Curtiss.....C-6	6	Vert....	4½"	6"	573	160	1750	Dir....	13.5	.50	.02	.52	420	16	436	127.	5.2	Z.....	B.....	60	30¼	22¼	24⅛	15¾
Curtiss.....C-12	12	V-60°...	4½"	6"	1145	400	2250	1.67	35.6	.50	.03	.53	685	.....	.....	131.0	5.46	C.....	B.....	68⅝	40⅛	27⅛	24⁵/₁₆	15¾
Curtiss.....CD-12	12	V-60°...	4½"	6"	*1145	325	1800	Dir....	29.6	.50	.03	.53	660	32	692	136.0	5.46	C.....	B.....	57¼	44⅛	27⅞	28½	15¾
Curtiss.....K-6	6	Vert....	4½"	6"	573	150	1700	Dir....	13.0	.52	.03	.55	417	16	433	122.0	4.91	Z.....	B.....	63	39¼	22⅛	24⅛	15¾
Curtiss.....K-12	12	V-60°...	4½"	6"	1145	375	2250	1.67	34.2	.52	.03	.55	700	32	732	121.0	5.66	B.....	Bl.....	68⅝	40⅛	27⅞	24⅝	15¾
Curtiss.....OX-5	8	V-90°...	4"	5"	502	90	1400	Dir....	9.3	.60	.03	.63	390	.....	.....	114.0	4.98	Z.....	Bl.....	55⅜	31½	29¾	17¾	12³²/₃₂
Curtiss.....OXX-6	8	V-90°...	4¼"	5"	557	100	1400	Dir....	10.0	.60	.03	.63	412	.....	.....	99.5	4.85	Z.....	Di.....	55½	30⅝	29⅝	18¼	.....
Gnome†‡.....G-V	9	Rotary..	4.33	5.9	920	100	1200	Dir....	11.5	.72	.183	.903	272	None..	272	88.1	4.9	None..	A.....	38⅜	38⅝	38⅜	.....	.....
Hall-Scott....A-5-A	6	Vert....	5¼"	7"	865	160	1350	Dir....	15.0	.565	.025	.590	595	.....	.....	107.0	4.6	Z.....	Di.....	62½	42⅜	22¼	27⅝	16
Hall-Scott....A-7-A	4	Vert....	5¼"	7"	577	110	1400	Dir....	10.0	.58	.035	.615	456	.....	.....	102.0	4.67	Z.....	Di.....	49¼	39⅝	18⅛	27⅝	16
Hall-Scott.....L-4	4	Vert....	5"	7"	550	125	1700	Dir....	11.9	.598	.02	.618	385	.....	.....	110.0	5.25	M.....	D.....	52	41¾	22	20¾	16
Hall-Scott.....L-6	6	Vert....	5"	7"	825	200	1700	Dir....	16.0	.56	.03	.59	550	25	575	112.9	5.25	S.....	D.....	65	44¼	20¾	20¾	16
Hispano-Suiza†....A	8	V-90°...	4.724	5.118	718	150	1450	Dir....	14.0	.52	.05	.57	445	41	486	114.0	4.8	S.....	Di.....	51¼	32¾	33⅞	17⅝	13³²/₃₂
Hispano-Suiza†....E	8	V-90°...	4.724	5.118	718	185	1750	Dir....	16.0	.52	.056	.576	470	41	511	124.0	5.33	S.....	Di.....	50²⁵/₃₄	32¾	33⅞	17⅝	13³²/₃₂
Hispano-Suiza†....H	8	V-90°...	5.5	5.9	1122	317	1700	Dir....	29.7	.586	.025	.611	596	58	654	131.0	5.33	S.....	Di.....	51¹³/₃₂	39¹³/₃₂	38⅜	23½	14⅝
Lawrance†.....L-3	3	Radial..	4¼"	5¼"	225	60	1800	Dir....	5.1	.50	.04	.54	140	None..	140	120.0	5.0	S.....	P.....	20⅜	35⅝	35½	.....	.....
Liberty.....A	12	V-45°...	5"	7"	1649	420	1800	Dir....	34.9	.52	.032	.55	822	46	868	115.0	5.5	Z.....	D.....	71⅝	41⅛	26⅜	27	17
Liberty.....C	12	V-45°...	5"	7"	1649	380	1600	Dir....	31.6	.52	.032	.552	822	46	868	112.0	5.0	Z.....	D.....	71⅝	41⅛	26⅜	27	17
Packard....1-A-744	8	V-60°...	4¾"	5¼"	744	208	1800	Dir....	16.5	.50	.03	.53	520	.....	.....	122.0	5.0	Z.....	D or M	49⅞	40¼	27⅛	20½	14½
Packard..1-A-1237	12	V-60°...	5"	5¼"	1237	345	1800	Dir....	27.5	.50	.02	.52	738	39	777	125.0	6.5	Z.....	M.....	63⅜	35⅝	27⅛	20½	14½
Packard..1-A-2025	12	V-60°...	5¾"	6½"	2025	570	1800	Dir....	43.6	.48	.03	.51	1120	51	1171	123.0	5.0	Z.....	D.....	71⅝	46½	31¼	23¾	17¾
Rausie.....E-6	6	Vert....	5"	6"	707	175	1650	Dir....	15.0	.50	.038	.538	514	25	539	118.0	5.5	S.....	Di.....	58	46½	23	30	15⅝
Union.....3-6	6	Vert....	4¾"	6½"	691	120	1375	Dir....	8.0	.56	.018	.578	485	.....	.....	109.0	5.5	Z.....	Di.....	69½	53¼	24	30¼	16
Wright.....E-2	8	V-90°...	4.724	5.118	719	190	1800	Dir....	15.0	.480	.02	.500	480	45	525	116.4	5.5	S.....	Di.....	49⅛	34⅜	33⅞	18¾	13³²/₃₂
Wright.....H-2	8	V-90°...	5.5	5.91	1126	325	1800	Dir....	26.7	.50	.02	.52	625	58	683	127.0	5.5	S.....	Di.....	51²³/₃₂	39¹³/₃₂	38⅜	23½	14⅝

*Low compression model. †Manufacture discontinued. Included because of number in use or available from Government surplus. ‡Air cooled. All others water cooled.

ABBREVIATIONS: Dir—Direct. **Carbureters: B**—Ball & Ball; **C**—Claudel; **M**—Miller; **N**—None; **S**—Stromberg; **Z**—Zenith. **Ignition: A**—A.D.S.; **B**—Berkshire; **Bl**—Berling; **D**—Delco; **Di**—Dixie; **M**—Magneto; **P**—Philbrin.

Labor Statistics Indicate Recent Industrial Trends

Strikes occurred with about the same degree of frequency during 1920 as in past years, but a larger percentage were fought over increased wages. A. F. of L. membership now 4,078,740. Number of members participating in strikes 213% greater than ever before. 3,473,466 men are out of work, and wage reductions are common. Interesting conclusions drawn.

By Norman G. Shidle

THE striking thing about any compilation of labor statistics is the absence of data concerning the really vital features of human relationships in industry. The figures available are of interest chiefly as an indication of some of the broader trends of the times and as a somewhat complete record of the activities of labor which is organized in some form.

Insofar as the activities of organized labor are similar to the thoughts and desires of all the men who work, the labor statistics available are valuable. Where these activities are merely the expression of the organized groups which conduct them, their importance is accordingly diminished. It is useless to approach any discussion of current labor statistics without a full realization of these limitations.

Certain very definite values, however, may be obtained from a survey of such statistics. It is with a view to gaining those values that the present data are presented in a form calculated to bring out the points most pertinent to the larger discussion of labor and industrial relations problems in general.

Labor unrest as manifested in its most virulent form, that of strikes, showed no signs of materially decreasing during 1920. The figures given here are complete for the first three-quarters of 1920, and were compiled by the Bureau of Labor Statistics of the Department of Labor. Following is the record of strikes and lockouts during the last five years.

	Strikes	Lockouts
1916	3,681	108
1917	4,324	126
1918	3,232	105
1919	3,253	121
1920 (¾ yr.)	2,724	67

While figures for the last quarter of 1920 are not yet available, it is probable that this quarter will show a relatively small number of strikes as compared with the corresponding period of the preceding year. The large amount of unemployment and the consequent decline in the fighting power of the unions doubtless has had an effect upon the number of strikes. Since this decrease in the number of strikes, however, is due to the change of economic conditions and not to any fundamental adjustment in the relations between capital and labor, it is fair to say that the strike records show industrial unrest to be about the same as in previous years.

PRINCIPAL CAUSES OF STRIKES AND LOCKOUTS 1916, 1917, 1918, 1919, AND FIRST THREE-QUARTERS OF 1920
(Approximate Percentages)

Matter in Dispute	STRIKES					LOCKOUTS				
	1916, per Cent	1917, per Cent	1918, per Cent	1919, per Cent	1920, per Cent	1916, per Cent	1917, per Cent	1918, per Cent	1919, per Cent	1920 per Cent
For increase of wages	35.10	35.60	42.50	30.42	45.52	10.57	13.50	13.49	19.86	29.81
Because of decrease of wages	1.00	0.80	1.07	2.46	1.18	1.84	1.59	1.93	2.48	.....
Non-payment of wages	0.35	0.40	0.98	0.28	0.84	....	0.79	.....	.....	.....
Because of increase of hours	0.08	0.40	0.19	0.25	2.25	2.67	.....	.....	.....	.....
For decrease of hours	3.02	2.89	2.48	3.26	2.02	1.84	3.97	.....	6.60	1.48
For increased wages and decreased hours	13.04	8.80	7.80	17.01	7.90	1.84	3.17	1.93	7.43	5.99
Recognition of union	9.36	6.50	5.84	11.31	6.52	20.20	31.00	33.60	25.65	25.39
Recognition and wages	3.32	3.50	3.00	3.91	3.18	1.84	3.97	1.93	4.14	7.50
Recognition and hours	0.60	0.64	0.50	0.59	0.15	0.92	0.79	.....	0.83	.....
Recognition, wages and hours	1.85	1.32	2.08	5.49	0.99	4.59	.....	.....	5.79	4.47
Recognition and conditions	.....	0.30	0.22	0.44	.....	.....	.....	.....	.....	.....
General conditions	1.58	2.25	1.70	1.76	2.89	.....	3.17	1.93	.....	4.47
Conditions and wages	1.52	1.65	1.57	1.66	1.32	1.84	0.79	1.93	0.83	4.47
Conditions and hours	0.08	0.40	0.06	0.05	0.09	.....	0.79	.....	.....	.....
Conditions, wages and hours	0.68	0.61	0.25	1.14	0.37	.....	.....	.....	.....	1.48
Discharge of foreman demanded	0.46	0.88	1.67	0.46	1.32	.....	0.79	.....	.....	.....
Because of discharge of employees	3.32	4.80	4.30	4.35	3.49	4.59	2.38	.....	.....	1.48
Employment of non-union men	2.00	1.80	1.92	.....	1.62	3.67	0.77	.....	.....	.....
Relative to agreement	1.03	1.77	1.29	1.01	0.84	1.84	2.38	.....	3.31	.....
New Agreement	1.01	0.52	0.12	1.11	0.82	2.75	1.59	....	.....	1.48
Sympathy	0.87	1.61	1.07	3.08	2.75	0.92	0.79	0.97	.....	.....
Jurisdiction	0.52	0.47	0.50	0.46	0.46	.....	.....	.....	0.83	1.08
Miscellaneous	3.18	4.09	5.34	2.80	.....	2.75	3.97	8.70	12.41	.....
Not reported	16.00	18.00	13.55	6.60	10.54	30.30	23.80	33.60	9.99	10.50
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Fig. 1

Causes of Strikes

The causes of strikes as announced in the statistics constitute the points over which came the actual breaks between employer and employee. They do not constitute the fundamental reasons for industrial unrest.

A larger percentage of strikes was caused in 1920 by the single issue of wages than in any previous year. Forty-five and one-half per cent of all the strikes which occurred in 1920 hinged upon a demand for increased wages alone, while 59.47 per cent of the strikes involved the question of wages in one form or another.

The predominance of the wage question as the breaking point of strikes made other causes diminish proportionately. There is no other single cause which stood out prominently, the most important of the causes not involving wages in any form being the question of recognition of the union, only 6.52 per cent of

INDUSTRY GROUPS IN WHICH THE LARGEST NUMBER OF STRIKES AND LOCKOUTS OCCURRED IN 1916, 1917, 1918, 1919, AND FIRST THREE-QUARTERS OF 1920

Industry	STRIKES					LOCKOUTS					Grand Total
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	
Building trades	376	447	416	424	433	18	21	16	18	8	2,177
Clothing industries	222	483	416	301	215	5	12	18	7	10	1,689
Furniture industry	48	40	25	44	11	2	3	1	3	..	577
Iron and steel workers	72	56	72	67	23	..	..	2	8	1	301
Leather workers	34	19	15	27	19	..	..	1	5	4	124
Lumber industry	44	295	75	39	28	..	4	1	2	2	490
Meat cutting	70	38	39	67	25	..	2	..	2	1	244
Metal trades	547	513	439	527	330	14	31	23	29	9	2,463
Mining	402	418	184	170	115	3	2	5	2	1	1,302
Paper manufacturing	51	39	35	41	29	2	1	..	3	2	203
Printing and publishing	25	40	39	58	46	4	3	4	3	1	223
Shipbuilding	27	103	136	101	39	..	..	3	1	1	411
Stonework	59	26	14	13	27	2	..	..	..	..	141
Textile industry	258	242	209	258	204	3	5	3	9	3	1,194
Tobacco	61	45	47	54	22	2	2	2	2	..	237
Transportation	224	342	226	231	238	4	1	1	3	3	1,273

Fig. 2

the conflicts being precipitated on this particular issue.

An examination of the other strike causes shows a similarity in proportion to those of other years both in numbers and percentages. The chief conclusion to be drawn from a study of this table is that the questions over which the actual break in relations usually come assume about the same relative importance each year. It would seem to indicate a rather discouraging tendency on the part of both organized labor and some employers to "fight it out along these lines if it takes . . . forever."

The record of lockouts shows nearly the same tendencies. During 1920 the percentage of lockouts occasioned by demands for increased wages increased 10 per cent, but this merely indicates that many of the miscellaneous troubles of past years have been concentrated into this one point by the labor unions. The percentage of lockouts because of demands on the part of the workmen for union recognition continue in practically the same proportion, last year being 25.39 per cent and the year before 25.69 per cent.

A larger percentage of lockouts involved working conditions in 1920, 4.47 per cent being attributed to this cause.

Building Trades Lead Striking Groups

The number of strikes occurring in some of the chief industrial groups is shown in Fig. 2. In 1920 the building trades conducted the largest number of strikes, while the clothing workers suffered the greatest number of lockouts. The leading industry groups as to number of strikes conducted during the first three-quarters of 1920 line up as follows:

Building trades	433
Metal trades	331
Transportation	238
Clothing industry	215
Textile industry	204

Comparing these figures with those of past years, it becomes evident that there has been a considerable decrease of trouble in the metal trades during 1920. In 1919 the metal workers struck 527 times, in 1920 only 331. The building trades, on the other hand, though leading the list in 1920, had about the same number of strikes as in past years.

Taking a period of five years, however, including 1920, the metal trades have caused the most troubles. The list for this longer period appears in this order, including both strikes and lockouts:

Metal trades	2463
Building trades	2177
Clothing	1689
Mining	1302
Transportation	1273

There has been a fall in the number of mining strikes during the last year, but the seriousness of the situation in this industry has probably increased materially, nevertheless.

Strikes of Less Duration

Fig. 3 shows the duration of strikes during the last five years. In 1919, 29.25 per cent of the strikes listed in this table lasted from one to three months, while in 1920 this percentage was reduced to 24.65 per cent. The percentage of those lasting from 1 to 2 weeks, however, increased during 1920 from 15.78 per cent to 18.70 per cent. These two periods represent the lengths of time during which the greatest number of strikes endured.

The figures for five years bear out this tendency, as 1305 strikes during that period lasted from 1 to 3 months and 1257 lasted from 1 to 2 weeks.

The figures on lockouts indicate that once a lockout starts it has an excellent chance of continuing for a considerable length of time; a better chance, in fact, than the strike. The reason for the new impetus given to strikes after the two-week period is that the payment of strike benefits by the union begins at that time.

The figures for lockouts, however, show that in 1919 52 per cent of the lockouts lasted from 1 to 3 months, while only 29 per cent of the strikes endured that long. Similarly in 1920, 31 per cent of the lockouts lasted as long as this and only 24 per cent of the strikes. Moreover, the total figures for five years show that nearly 19 per cent of the lockouts lasted more than three months, while only 5.7 per cent of the strikes were carried on through a period of equal length. This indicates that the economic power of the employer is usually in a better position to withstand a long industrial battle than is that of the labor union. It is obvious, however, that the ability to win a strike may not constitute the *summum bonum* of a successful labor policy.

New York Has Most Trouble

New York and Pennsylvania maintain their unenviable position as leaders in the number of industrial disputes

DURATION OF STRIKES AND LOCKOUTS ENDING IN 1916, 1917, 1918, 1919, AND FIRST THREE-QUARTERS OF 1920

	STRIKES					LOCKOUTS					TOTALS		Grand Total
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	Strikes	Lockouts	
1 day or less	179	282	227	98	37	...	2	2	...	...	823	4	827
2 days	183	111	168	64	33	2	2	3	1	...	559	8	567
3 days	146	102	124	74	22	1	3	...	...	1	468	5	473
4 days	124	61	111	73	25	1	1	1	...	...	394	3	397
5 to 7 days	330	213	247	161	52	6	3	2	3	2	1,003	16	1,019
				15.73%	18.70%								
1 to 2 weeks	408	215	264	265	105	10	4	6	4	2	1,257	26	1,283
2 to 3 weeks	224	118	151	190	40	7	3	6	9	3	722	28	751
3 to 4 weeks	99	54	70	109	45	2	4	2	...	1	377	9	386
				29.25%	24.65%								
1 to 3 months	266	185	222	493	139	6	8	10	29	5	1,305	58	1,363
Over 3 months	104	60	49	155	65	18	4	2	10	2	433	36	469

Fig. 3

NUMBER OF STRIKES AND LOCKOUTS BEGINNING IN EACH YEAR IN SOME OF THE CHIEF INDUSTRIAL STATES 1916, 1917, 1918, 1919, AND FIRST THREE-QUARTERS OF 1920

	STRIKES					LOCKOUTS					TOTALS		Grand Totals
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920	Strikes	Lockouts	
New York	577	696	668	515	459	15	15	21	7	9	2,915	67	2,982
Pennsylvania	566	481	304	265	202	8	13	7	10	5	1,818	43	1,861
Massachusetts	374	342	341	376	366	9	11	4	6	7	1,799	37	1,836
New Jersey	411	219	138	171	120	6	8	...	4	1	1,059	19	1,078
Ohio	276	265	188	214	170	14	14	9	8	10	1,113	55	1,168
Illinois	149	276	237	252	202	10	6	11	10	6	1,116	43	1,159
Connecticut	325	178	90	120	124	1	...	2	3	2	837	8	845
Washington	57	290	126	78	54	1	4	2	...	2	605	9	614
Missouri	90	117	100	63	53	7	5	5	2	...	423	19	442
Minnesota	24	52	40	49	48	6	1	...	1	2	213	10	223
Indiana	70	65	68	91	64	5	8	8	9	4	358	34	392
Michigan	66	62	59	79	44	5	2	1	...	3	310	11	321

Fig. 4

during the first three-quarters of 1920, as shown by Fig. 4. This is rather to be expected, however, since the number of strikes is always likely to vary with the degree of labor organization and both of these states are comparatively highly organized.

Michigan, an important industrial State also, is low in the list of industrial disputes resulting in strikes. This is probably due to the fact that organized labor has a comparatively small hold in that State as compared with Pennsylvania and New York. The actual number of strikes would naturally be lower in Michigan because of its smaller industrial population, but the proportionate number is also somewhat smaller.

Although fifth in the list of total strikes, Ohio has had more lockouts than any State except New York.

For five years the total number of strikes in the States that have been most troubled in this respect is as follows:

New York	2915
Pennsylvania	1818
Massachusetts	1799
Illinois	1116
Ohio	1113

NUMBER OF STRIKES AND LOCKOUTS BEGINNING IN EACH MONTH, 1916, 1917, 1918, 1919, AND FIRST THREE QUARTERS OF 1920

Year	January	February	March	April	May	June	July	August	September	October	November	December	Month not stated	Total
Strikes;														
1916	180	203	289	419	604	340	310	318	247	257	193	147	174	3,681
1917	274	204	308	431	451	313	444	353	340	317	251	184	454	4,324
1918	183	212	300	308	385	289	279	273	197	145	202	239	220	3,232
1919	184	183	175	248	388	303	360	373	377	296	145	94	127	3,253
1920	205	194	296	399	394	348	296	277	234	...	...	...	183	2,826
Lockouts;														
1916	8	3	5	15	13	14	3	8	5	4	4	2	24	108
1917	14	7	10	14	12	10	4	7	9	4	6	12	17	126
1918	8	11	11	11	6	6	6	5	10	...	5	10	16	105
1919	5	7	6	14	25	12	6	10	13	8	6	6	3	121
1920	6	5	6	5	12	14	7	15	5	...	...	...	7	83
Total;														
1916	188	206	294	434	617	354	313	326	252	261	197	149	198	3,789
1917	288	211	318	445	463	323	448	360	349	321	257	196	471	4,450
1918	191	223	311	319	391	295	285	278	207	145	207	249	236	3,337
1919	189	190	181	262	413	315	366	383	390	304	151	100	130	3,374
1920	211	199	302	404	406	362	303	292	239	...	...	...	190	2,908

Fig. 5

Most Strikes Begin in April

Fig. 5 shows the number of strikes beginning in each month. It will be noted that the largest number begin in the spring months in general and in April and May in particular. This fact can be attributed to two causes. First, that less physical hardship accrues to the workman when a strike is conducted in warm weather. Second, many union agreements terminate in the months of April and May and disputes frequently occur in the making of a new agreement.

Who Is Winning?

Figures for the half of 1920, shown in Fig. 6, indicate that the battle between employers and employees is still about a draw in so far as the winning of strikes is concerned. The figures at hand show that an exactly equal number was won by both sides during this period.

It should be noted, however, that every time a strike is compromised the employer has, in a sense, lost, since labor has gained something which it did not have under the previous *status quo*. And even when the employer wins a strike, he has lost in charges for overhead expense, lost production, etc. Thus it would seem to be apparent that the employer, at least, never has anything to gain from a strike, whether he is strong enough to "win" it technically or not.

For this reason, if not for many others, it is not likely to be advantageous to the employer to lay an excess of emphasis upon the "fighting" phases of his future labor policy. Every time there is a pitched battle, he loses. The very fact that he has capital invested in plant and equipment makes the cards stacked against him.

RESULTS OF STRIKES AND LOCKOUTS ENDING IN 1916, 1917, 1918, 1919, AND FIRST OF 1920

RESULTS	STRIKES ENDING IN—					LOCKOUTS ENDING IN—				
	1916	1917	1918	1919	1920	1916	1917	1918	1919	1920
In favor of employers	727	382	450	624	136	21	13	6	18	8
In favor of employees	733	614	610	533	136	16	17	16	16	4
Compromised	766	698	668	729	172	11	21	17	11	7
Employees returned pending arbitration	70	131	200	42	35	3	6	5	3	..
Not reported	99	190	188	33	180	2	1	21	20	2
Total	2,395	2,015	2,116	1,961	659	53	58	64	68	..

Fig. 6

A. F. of L. Statistics

The statistics concerning the American Federation of Labor are compiled upon a fiscal year basis, the fiscal year of this organization being June 1 to June 1. Consequently the figures presented here for 1920 are really for 1919-1920. Fig. 7 shows the growth of the A. F. of L. as to charters and membership. A gain in membership of 818,740 is recorded during the last year, bringing the total membership up to 4,078,740.

The figures show a net gain of about 4000 charters for the year, approximately 37,000 local unions now being affiliated with the Federation. The chart shown in Fig. 8 depicts the growth of the A. F. of L. since its founding in 1881.

It is probable that some drop in membership will be noted when the figures for 1921 appear next June, since an industrial depression of the present kind always has a definite effect upon union membership. This is largely a matter of inability to pay dues and the necessity for getting work of some kind to tide over the bad times, whether it be in conformity with union regulations or not. While union officials will not officially admit that they expect a drop in membership, there is little doubt but that they realize the very strong possibility of such a change.

The strike statistics of the A. F. of L., covering a period of ten years, shown in Fig. 9, present some interesting facts. The number of strikes decreased during 1920, but the numbers involved increased 213 per cent, as compared with the number involved during the previous year. Nearly two million men were involved in the strikes conducted by the A. F. of L. during 1920, nearly two-thirds as many as comprised the entire citizen army raised by the United States to fight the war against Germany and her allies.

In other words, the A. F. of L. was able to muster 213 per cent more striking power in 1920 than ever before. And as a result of this increased striking power, it benefited 188 per cent more men than before.

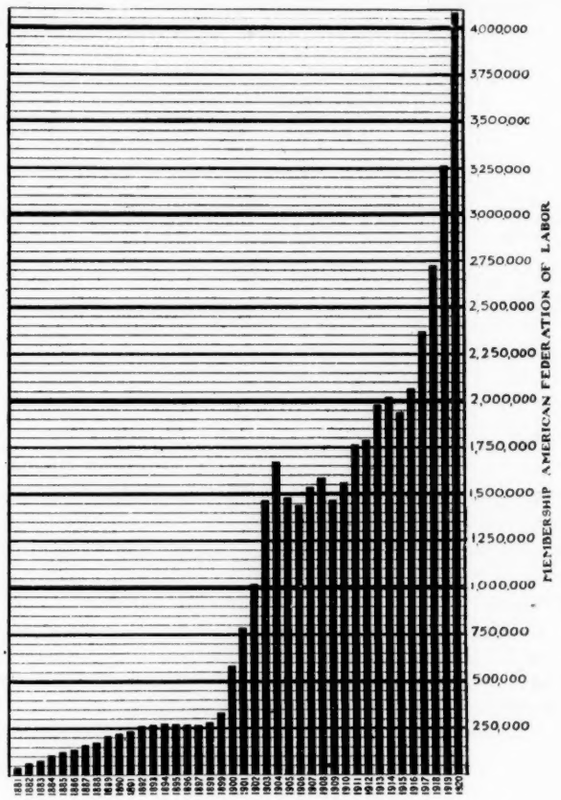


Fig. 8—Membership of American Federation of Labor 1881 to 1920

Cost of Strikes

The cost of conducting these strikes during 1920, although larger in the aggregate than during 1919 and 1918, was not as large as the aggregate for 1911, 1913 and 1915 when far less men were involved and benefited.

STATISTICS CONCERNING AMERICAN FEDERATION OF LABOR

	National and International Unions	Local Unions	Charters Issued	Charters Surrendered	Gain in Membership
1911	...	.....	2,345	1,358	117,568
1912	112	20,964	2,388	1,422	216,012
1913	111	20,046	2,682	1,348	295,695
1914	110	21,460	2,578	1,351	62,822
1915	110	21,887	1,791	1,421	38,509
1916	111	21,711	2,699	4,403	267,152
1917	111	26,761	3,793	1,557	319,671
1918	111	27,755	2,977	1,052	591,498
1919	111	33,852	6,743	1,719	825,449
1920	110	37,000	5,449	1,639	818,740

Fig. 7

The total cost of strikes to the A. F. of L. during the last ten years has been $28,581,587. This is a staggering total when interpreted in terms of economic loss. When it is remembered that as much has probably been expended by employers, either directly or indirectly, in combating the activities of this organization the figures present a startling total, and a rather practical indictment of the present methods of conducting industrial relationships.

There is no ready made plan that can be adopted to eliminate this prodigious waste, but a constant and conscientious study of all the factors involved in human relationships in industry will gradually reduce the sums expended to organize and equip industrial fighting machines. Merely fighting the unions, without building very definitely in a constructive way, offers no solution to the labor problem; the problem which involves this enormous economic waste.

There are two ways of combating the problem. The one, to organize funds and forces with which to do battle with labor and its organizations which make certain demands inconsistent with efficient production and true economic service. The other, to study the fundamental causes which underlie industrial unrest, investigate and experiment in methods of eliminating those causes, and seek through hard work and thoughtfulness to bring human relationships in industry to a sane and normal condition mutually satisfactory to employer and employee.

Certainly the sum of about $60,000,000 expended in industrial warfare during the last ten years could have been more effectively and beneficially used if employers had been able to work out in a practical way some

AMERICAN FEDERATION OF LABOR STRIKE STATISTICS

	Number of Strikes	Strikes Won	Strikes Lost	Strikes Compromised	Strikes Pending	Number Involved	Number Benefitted	Cost of Strikes
1911	1,086	642	93	90	261	170,526	104,655	$4,709,551
1912	772	378	61	58	275	73,069	6,177	1,928,381
1913	969	554	65	89	261	294,644	186,644	3,345,721
1914	957	543	60	118	236	131,324	74,350	4,280,307
1915	1,004	552	119	115	218	144,932	99,543	3,418,831
1916	1,622	1135	49	133	305	260,015	126,181	2,708,789
1917	1,417	897	86	120	314	194,802	215,019	2,291,087
1918	922	570	43	108	201	140,042	134,033	1,295,031
1919	1,515	1030	52	170	263	234,466	203,876	1,391,833
1920	1,255	706	88	186	275	734,056	587,479	3,212,056
Totals	11,501	7007	716	1187	2609	2,377,468	1,737,957	$28,581,587

Fig. 9

method of handling human relationships which would give every man a real opportunity for individual development and a square deal in every phase of his contact with the factory and the industry.

A Comparison

While all of the strikes listed by the Department of Labor are not, of course, A. F. of L. strikes, it is likely that a good proportion of them are, since the A. F. of L. is by far the largest labor organization in this country. And the vast majority of strikes are conducted by organized labor. The graphic chart shown in Fig. 10 presents the results of strikes during the years of 1916, 1917, 1918 and 1919 as shown by the figures of the Bureau of Labor Statistics and by the A. F. of L. While it is not to be expected that these curves would coincide, it would be reasonable to expect that some similarity of proportion would exist between the two.

The relative position of the lines is of interest in connection with this chart—not the actual figures. For example, granting that strikes seldom occur except when employees are organized and that the A. F. of L. includes the vast majority of organized employees in this country, it would follow that the proportion of strikes won by employers in A. F. of L. strikes would be relatively the same as the percentage of strikes won by employers in all the strikes recorded, and similarly, in regard to the strikes won by employees and strikes compromised.

The chart shows, however, that in the case of the Bureau of Labor statistics figures the number of strikes won by employers and employees, for instance, was almost the same in 1916, while the A. F. of L. figures show the number won by employees to be about nineteen times as great as the number won by employers. The relation may be expressed in a proportion which brings out clearly the divergence:

Employers won: employees won: compromised:
1:20:3 (A. F. of L. figures)
1:1 1/58:1 5/58 (Labor Dept. figures)

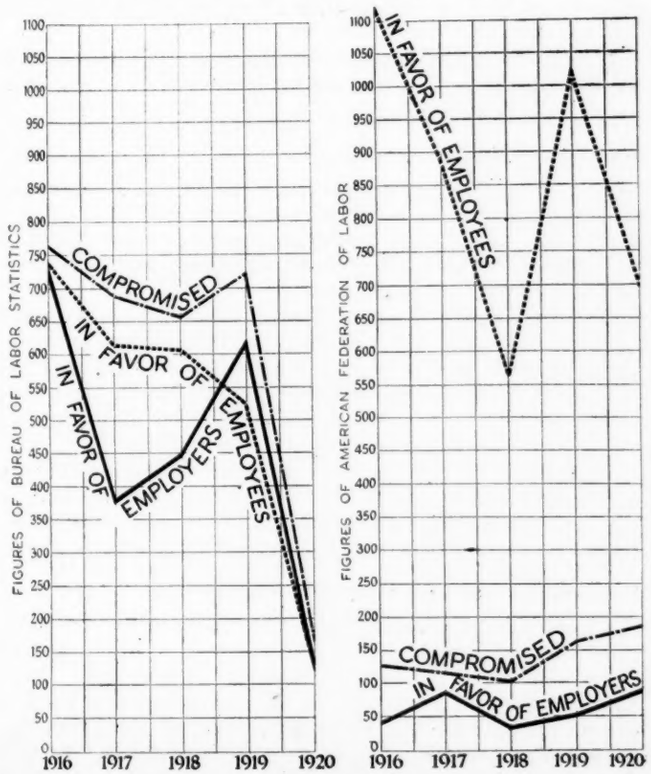


Fig. 10

A similar divergence is noted in the examination of figures for other years. The number of strikes won by employees in the A. F. of L. curve never approaches even closely the curve of strikes won by employers, while on the other chart this first line crosses the latter at one point and practically meets it at two others.

This case is cited chiefly as an example of the difficulties which are encountered in attempting to reach any definite conclusions in regard to labor problems on the basis of published statistics. The absence of standards of compilation and definition of terms renders it almost impossible to obtain anything like accurate figures in a great many cases.

Unemployment

The recent survey of unemployment made by the U. S. Employment Service presents the best figures available. This was, in fact, a survey of employment rather than of unemployment. The number of employees at work in the various plants throughout the country was determined and the total subtracted from a similar total of a year before.

It was found that 3,473,466 less persons were employed than a year ago. It is reasonable to take this figure as a close estimate of the number of unemployed in the United States at the time of the survey, which ended about Jan. 25.

This is true because all the industries and all the States throughout the country were covered by the survey. The only place men could have gone without being unemployed now is back to the farms. Since most of the extra farm work was over before the survey started, and since the survey covered the entire country, nearly this number of men must be regarded as unemployed at present.

The automobile trade showed the biggest reduction with a loss of 69 per cent, while the building trades were second with 52 per cent. Following is a list of reductions in some of the chief industries:

	Per cent
Automobile and accessory	69
Building trades	52
Textile	35.5
Leather	35
Lumber and house furniture	32
Metal trades, foundries, etc.	30.5
Packing	19
Clay, glass, cement, etc.	19

Michigan showed a greater proportion of reduction than any other State, with 82 per cent less employees than a year ago. This does not necessarily mean that all these idle men are still in the State of Michigan, but it does mean that they are probably idle somewhere. Following is the percentage of reduction in some of the chief industrial States:

	Per cent
Michigan	82
Ohio	50
Indiana	50
Illinois	44
Connecticut	43
Massachusetts	38
Wisconsin	32
New York	28
New Jersey	22

It is worth while to consider these figures concerning unemployment in connection with those concerning strikes and industrial unrest. An industrial condition such as prevails at the present time makes less blatant the voice of organized labor and in that sense promises for the time being less virulent labor trouble. It may be said that industrial depression reduces unrest so far as organized labor is concerned.

At the same time, a knowledge of human nature leads to the belief that industrial depression tends to increase unrest so far as the individual is concerned. Henry L. Doherty, president of the Cities Service Co. of New York, recently voiced this idea when he said in effect that he believed hunger to be more provocative of radicalism than high wages and plenty of work. It is natural for the man who is out of work and in trouble to come rapidly to the conclusion that something is wrong with the world. He will probably come to this conclusion through a successive series of psychological reactions than through any ordered method of reasoning, but if he is "out of luck" long enough he is almost certain to arrive there.

And just as it is necessary to work from the individual to the group in seeking to make permanent adjustment of human relationships in industry, so is the unrest which germinates and grows in a number of individuals likely in the long run to be more troublesome and potent than even the organized labor movement which begins with the group and works down to the individual.

The figures on strikes are printed in this article. The figures on industrial unrest as comprised in the more important factors of individual convictions and reactions can never be gathered. But they are none the less important and must be recognized and seriously considered, even though immediate circumstances show on the surface a cessation of active industrial unrest. It is for this reason that attention is called to them in this article, even though statistics cannot be compiled to accompany the discussion. It brings again to light the idea that a study of the individual and the proper attention to his development and desires is the first requisite in attempting to find a permanent solution to labor difficulties.

Wages and Cost of Living

Wages are now generally in a state of flux, so that wage statistics which might have been compiled yesterday would not be a true picture of the condition to-day. Moreover, general wage surveys, by whomever made, are usually open to so many criticisms and objections as to render them of comparatively minor value.

Cost of living surveys are open to the same criticism. Yet there is a certain value in surveys made at stated periods on the same basis by a single competent agency. It is almost impossible, however, to get satisfactory statistics upon which to compare in a general way cost of living and wages. It may be very possible and valuable, however, to make such comparison in a specific case or for a small unit.

With this thought in mind, the chart shown in Fig. 11 is presented. It shows the average rise and fall of the cost of living in 19 cities, all important in the automotive industry, from 1914 to 1920 inclusive. The chart has been prepared on the basis of figures compiled according to stable standards each year by the Bureau of Labor Statistics.

Similar wage scales, prepared by various other agencies, vary so materially that it has not been advisable to attempt the charting of a wage curve. It is possible, however, for any particular plant to plot its own wage curve along with the cost of living curve.

Wage Reductions

No complete data are available on wage reductions, but a survey of a large number of automotive plants reveals some general tendencies. The chief question concerns the time at which wages should be reduced and still give both employer and employee a square deal in the matter.

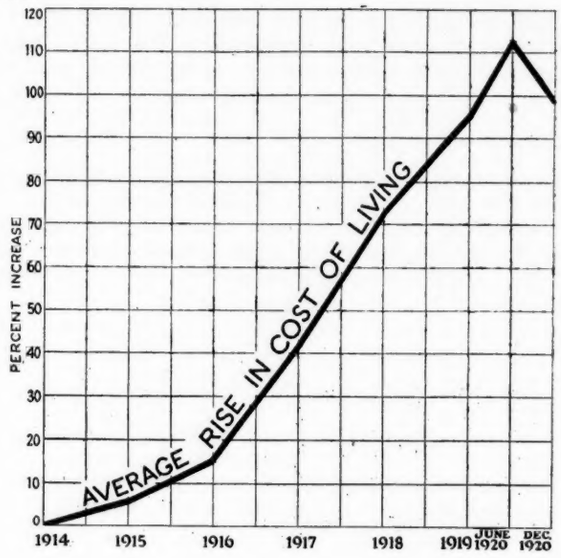


Fig. 11

Most factories have already reduced wages in one way or another. Even aside from reductions in working time, which temporarily reduce wages, a majority of firms have already made an actual cut in wages. There are still a number of firms, however, which have maintained wage scales up to the present time and which do not contemplate reductions in the immediate future unless there is a distinct drop in cost of living prices.

There has been great variation, however, both in the size of reductions made and in the method of making them. Some manufacturers have put the facts of the situation squarely before their employees and have taken considerable pains to sell them on the idea that reductions are necessary.

Others have simply posted a notice that reductions were to go into effect and stated how great the reduction would be.

Still others have discharged the men and superficially shut down their plant, to re-open it the next day and hire men back at lower rates.

Hours of Work

The question of hours has rather been reversed within recent months. Workmen have been desiring to work more hours than manufacturers have been able to allow them. This is the general condition at the present time.

In some cases, however, manufacturers have been coupling demands for increased working hours with demands for decreased wages. In other words, they indicate that the real reason for shutting down the plant is not lack of orders, but a desire to take advantage of the present situation to "put labor in its place."

This latter situation, however, does not apply to the automotive industry, so far as can be learned, and is merely mentioned as an indication of what is being done by some manufacturers in other lines of work.

Personnel Work and Shop Committees

There has been a falling off in the amount of "welfare" and personnel work being done in many plants since the beginning of the business depression. It is natural that this work should be contracted to a certain extent along with the other activities of the manufacturing plant, but in some places the curtailment in this department has been in much larger proportion than in any other department.

It will undoubtedly mean a great saving of wasted money in some plants to dispense with ill-conceived and not very effective "welfare" work. But even a superficial study of the situation shows that the over-curtailment of intelligent employment and personnel work will work great harm in the long run. As pointed out previously in AUTOMOTIVE INDUSTRIES, the present time offers an unusual opportunity for the manufacturer to put his house in order as regards industrial relations. By effective and intelligent personnel work in building his force back to normal, he can get together an organization of efficient, enthusiastic workers such as he has long been unable to obtain.

And for the very reason that many manufacturers will take advantage of the present situation to "get back at labor," the manufacturer who operates now on a real "square deal" basis will find himself in a very strong position when normal production is again resumed.

Shop committees have been abandoned in a few cases, but most plants which have had in operation an employees' representation plan for a considerable length of time are still operating on that basis. The present time will be one of real test for many of these plans, and some of those which have been operated most effectively and which were installed because the management honestly desired to consult with its employees and to give them a normal channel through which to obtain a practical working out of the "square deal" idea give every indication of weathering the present storm.

As stated at the beginning of this article, the unfortunate part about labor statistics is the utter absence of vital ones and the rather confused condition of many of those which are compiled. This is, of course, to be expected when dealing with anything so complex as the human element, but it is possible, nevertheless, for better and more valuable records to be developed in the future.

An Analysis of the Farm Lighting Plant Industry

(*Continued from page* 395)

leaving only an overcharging switch and sometimes a "restart" button exposed, the latter being used after a trouble stop has been made and the difficulty remedied. A noteworthy feature in connection with full automatic systems has been recently introduced by one manufacturer whereby the automatic control is instantly removable and may thus be sent to a service depot for repairs.

Engine Types.—Over 90 per cent of the engines used have one cylinder, 3 h.p. being the average maximum power for this class. Two cylinder engines are used with powers ranging between 3 and 8 h.p., fours between 8 and 20 h.p. and sixes for sizes larger. Only 4 per cent have two-stroke cycle engines, one is a semi-Diesel and the remainder are conventional four-stroke cycle engines, having low compression ratios to make them suitable for kerosene operation.

Air cooling is used on only 11 per cent of the models. Four are cooled by combination air and water, one uses oil for a cooling medium and the remainder are cooled by water circulating through an automobile type radiator or simple cooling tank.

The majority of four-stroke cycle engines use the poppet valve. Several use a rotating sleeve valve, one a Knight reciprocating sleeve, one a rotating disk valve.

Lubrication is most frequently by the conventional splash system. Ten per cent have pressure feed, especially the sleeve valve engines. Others use sight feeds, oil rings or oil cups. Babbitted bearings, frequently die-cast, are used most extensively although anti-friction bearings are becoming more general, being used for crank-pin bearings in some cases.

Over 25 per cent of the units are equipped with high-tension magnetos. Some of these are of the oscillating type. The remaining ignition systems consist of the plain battery-coil type.

The quality of engineering reflected by some of the engine designs compares quite favorably with the most advanced automobile practice. This is especially true of air cooling, aluminum pistons, reduction in inertia forces and the silencing of overhead valve engines.

Originally all plants were hand cranked. Now less than 10 per cent are so cranked. The progress of the present points to the development of full automatic systems. There are but 10 per cent of these now. As soon as electric plants are regarded as an electric service rather than a machine, more and more of our models will become automatic.

Present Status of German Automobile Industry

(*Continued from page* 413)

The enormous advancing of car prices, resulted in an annulment of signed delivery contracts by the factories described by me in my article of May 27, and the dealers came into a very difficult situation, because they had to arrange matters on the one hand with the customers, to whom only the dealer is responsible, on the other hand with the manufacturers. The result was many law suits and heavy expense. Consequently the German Automobile Dealers' Association was called upon to conciliate the strongly conflicting interests. The good results of the sales work done by the dealers were lost in large part. Their earnings furthermore were injured by the fact that the manufacturers endeavored to decrease the discount, in proportion to the advanced prices, in spite of the fact that the dealer had correspondingly advanced expenses.

The direct sale of army trucks and cars to the customers and to the motor traffic companies in a certain degree led to a disconnection of the automobile dealers and to a diminishing of their income. It also had the result, that casual dealers came in devoting only part of their time to the automobile trade. These men were interested only in making high profits immediately and thus lessened the earnings of the legitimate trade. In addition to this, the dealer did not receive any fuel from the government and was compelled to buy fuel in illicit trading at very expensive prices if he wanted to make a demonstration run for a customer. Consequently the German dealer has had a very hard task during recent months.

The repair shops essentially were subject to the same inconveniences as the factories, with the result that the working forces were systematically diminished or the shops shut completely.

The garage business, however, was very satisfactory on account of the large number of cars returning from the war and passing to the automobile trade.

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The 1921 Statistical Number

IN placing before you our 1921 edition of AUTOMOTIVE INDUSTRIES STATISTICAL NUMBER we have some misgivings. It is not that we have spared expense and effort to make our work all that it should be, but rather that in this fast growing industry we sometimes find ourselves in doubt as to what we can do that will be of most benefit to the industry.

Each year brings forth new phases of our industry—new industries within our own. There is still rapid development in what might be called the fundamentals of the great industry. The practice and trade lines have not as yet been stabilized to the extent of older industries. On all sides there are problems.

It has been necessary to make choice as to subjects to be developed. After making the selection every endeavor has been made to present the best information available. Care has been exercised in making this information accurate, even to the extent of excluding some last minute data which could not be checked. There may be some errors. We hope not.

We will welcome from any user of the STATISTICAL NUMBER suggestions for future editions.

The Engineering Value of Statistics

THE value of statistics to the engineer is quite generally recognized, but is worthy of emphasis and should receive even more general recognition than it is now accorded. Suppose, for example, that a manufacturer decides to put out a new chassis model. If this model is to be commercially successful and meet the least possible sales resistance it should not depart, at least in most particulars, from practice that is very generally employed and has proved most successful. Consequently it is necessary that both the engineering and sales departments have reliable information on current practice. This information may be possessed by members of the engineering force, but the industry is now so extensive that it is impossible for any engineer or engineering staff to keep up to date or keep record of any considerable proportion of changes being made by other concerns, unless recourse is had to published statistics. This need we endeavor to fill by data published from time to time in AUTOMOTIVE INDUSTRIES, and in particular in the statistical issue.

The information here published enables the engineer to know whether or not his judgment in selecting a given type of construction is confirmed by the judgment of other engineers called upon to make a similar choice. Of course the practice of following a certain procedure simply because a majority of other organizations do the same thing can be carried to excess. If the practice should be universally followed there would be little if any progress or improvement, but the value of the check which a study of statistics makes possible can scarcely be questioned.

Car manufacturers are not the only ones who benefit by the publication of statistics. The parts and accessory maker must follow the trend of competitors' design, as well as study the trend of selections made by the assembler. One of many possible illustrations will serve to prove this statement. In 1914 only 1 per cent of car models used the helical or so-called "spiral" bevel final drive. In 1915 the percentage rose to nearly 10 and in 1916 to over 55. To-day no less than 90 per cent of models employ this type of drive. No axle manufacturer could afford to overlook a trend of this character, yet if he failed in 1915 to equip his plant to supply the demand for the type of drive in question, he might easily have lost much business that would otherwise have been his in the following year.

The Need of Legislation

INCLUDED in this number of AUTOMOTIVE INDUSTRIES is a revision of the registration statistics published in the number of Jan. 13. In the present printing the numbers in several States have been changed and the total of cars and trucks has been

increased from 8,887,572 to 8,932,458. This change was made necessary for the reason that it was not possible to obtain at the time the former count went to press authorized statements from several of the State officials concerned with registrations. It was not the fault of these officials that this information was not available, but the fault of the system established by the State and which the officials are bound to carry out.

The gathering of registration statistics should be a simple task. It appears that all that is necessary is to ask the proper State official for his figures and add them to get the proper total. The task seems so simple that many persons have ventured to accomplish it. Most of these persons have learned that there is much more to it.

In the first place, the system of registration varies in each State. The classification of vehicles is different. In some States the total is not a right total at all. Some classifications must be subtracted, and in some cases classifications that look different must be included. The local meaning of re-registration, for instance, can be ascertained only by studying the law and the practice of the registration office. These factors may easily make a considerable difference in the grand total unless they are intelligently interpreted.

It is unfortunate for the great industry that there is not a more systematic registration of vehicles, and that the laws are not more uniformly enforced. As it is, a count of registrations from month to month does not in any sense indicate the purchase of motor vehicles in a given territory. Rather it indicates the degree of enforcement of the law in that territory. It also is true that a small percentage of motor vehicles escape registration while some motor cars are twice registered when they engage in interstate commerce. These factors probably balance themselves.

The remedy is obvious. It is a uniform registration law. This feature is included in the "Proposed Uniform Vehicle Law" drafted by the Motor Vehicle Conference Committee. If all States would adopt a uniform method of registration and a more uniform method of making accounts, this problem would to a large extent be solved. Another proposed solution is Federal registration. This, perhaps, would be welcome at a proper cost. Such a proposal has been made by the Secretary of the Treasury, but he wishes to charge the automotive vehicle owners $100,000,000 for this service. His plan would be merely to add another registration routine and fee to the present requirements. There already is grumbling among vehicle owners as to registration routine and fees. To add to this would draw a sharp up curve in the line of sales resistance. One can hardly believe that the States will give up the present privilege of taxing motor cars. The revenue is too great to be given up. Many municipalities now tax vehicles half as much as do the States. There must be no more taxes added.

One thing is certain: The automotive industry has within it a great political power. It is the second industry in importance and volume in the country. If this industry should unite in making a reasonable request it could not be denied. The fact that it suffers from bad legislation is its own fault. If the entire industry would place itself whole-heartedly on the side of fair and uniform legislation, it would get its desserts. This is the possibility. The facts are different. There is frequently division in the ranks of the industry as to legislation. Selfishness as to results sometimes crops out before the first score is made. If ever a situation required team work, it is the present situation as to automotive legislation. Forget details for the present and get behind the movement as represented by the Motor Vehicle Conference Committee.

Labor Statistics

THE exact meaning of any particular set of labor statistics is always difficult to determine for two reasons:

First: No clear definition of terms has become general; there is little standardization of terminology in this field of industrial organization, and consequently the statistician may be talking about one thing and his listener be thinking of another.

Secondly: The really vital factors of the labor and industrial relations problem have not yet been reduced to a definite and concrete form which will lend itself to statistical treatment. So many of these fundamental things lie within the minds and the psychological reactions of numerous individuals that in only isolated instances has their very presence been recognized; and in still fewer instances has a thoughtful, intelligent, and sustained effort been put forth to analyze them carefully and to determine what manner of things they actually are.

The chief value of labor statistics that are available—and of any that are likely to be available for many years—is that they do indicate in a general way certain broad facts and tendencies. The fact that there were more than two thousand strikes during the first nine months of 1920 indicates, of course, that an active industrial struggle is taking place, but the frequency of the strikes is no gage whatever as regards the increase or decrease of fundamental industrial unrest. It is merely a gage of the fighting strength of the unions and the employers.

So with figures showing the causes of strikes. These causes were merely the technical point over which the strikes broke in each case, and bear only a distant relation to the underlying causes, which must be traced back into the reactions of the various individuals comprising the employer and employee groups involved.

Present labor statistics, then, are useful as indicators of general trends of certain particular phases of the labor problem. They are of distinct value when put to such a use, and can be profitably studied from that standpoint. It is a mistake, however, to attempt to use them as accurate and detailed guides in any sense of the words.

It is an unfortunate fact that in utilizing any set of labor statistics for purposes of analysis, it is necessary to examine rather carefully the agency by which they were prepared and to understand the basic standards on which the final results were computed.

Concerted Tax Stand Is Essential

Industry as Whole Must Unite on Plan

Congress Sentiment Leans Heavily Toward New Levies on Motor Vehicles

WASHINGTON, Feb. 12.—Thorough inquiry into the attitude of Congressional leaders toward the tax problems of the automotive industry indicates strongly that unless there is a marked change of sentiment, a major portion of Secretary of the Treasury Houston's plan for additional taxes will be accepted without appreciable revision. Sounding out sentiment of Senators and committee leaders of the House revealed an unmistakable tendency to impose a tax which would check purchases of automobiles by individuals of small means. There are legislators who believe that imposition of additional taxes on motor cars would put the brakes on inflation which, they claim, is brought about by hundreds of thousands who buy machines on credit and cannot afford it.

These statements are based on personal opinions of Congressional leaders whose chief object is to raise revenue. Confidence seems to prevail throughout the industry that the recommendations of Secretary Houston for a 50c per horsepower tax would fail because of the inevitable opposition of 8,000,000 car owners. There are Congressmen who admit that such a tax would be inimical to the development of a great industry, but in the next breath say that it is the only logical way to reduce extravagance. With few exceptions, the advocates of this plan concede the essentiality of the automobile, but they claim that if horsepower and gasoline taxes were thus levied they would serve to stabilize general business through deflation. It is believed that the most effective opposition to the Treasury program will come from farming communities, where the effects of the tax would be quickly felt.

Will Act in New Session

The question of taxation will not be taken up until the next session, which probably will be called for March 14. Chairman Fordney of the House Ways and Means Committee advised AUTOMOTIVE INDUSTRIES to-day that tariff legislation would be disposed of and then attention devoted to questions of internal revenue. He stated that his time had been completely taken up with tariff matters so that he has made but little study of the probable effects the adoption of the Houston program would have on the automotive trade.

He declared that representatives of the industry would be allowed sufficient time to present their arguments as to taxation. Chairman Fordney pointed out that the committee was concerned solely with the problem of producing a yield of $5,000,000,000 or $8,000,000,000, a sum which is required to maintain the Federal Government and retire financial obligations during the next fiscal year.

The proposals of Secretary Houston, which would assess the automobile industry $290,000,000 over and above its present contribution to the public revenues, were suggested as a means of bringing more money into the Treasury. Recognizing the economic movement which must inevitably result from the new levy, certain Congressional leaders, stressing the necessity for economy in Governmental and private enterprise, have seized upon it as an effective weapon to force deflation.

Would Make Cars Luxuries

The attitude assumed by these agitators, whose methods of economy border dangerously on parsimony, is reflected in the statement of an influential legislator who said:

"There are thousands of people driving cars to-day who cannot make their payments and are so situated that they may never own the machine outright. This condition only helps inflation when it is deflation we want. If a man finds an automobile an essential utility then he

(*Continued on page* 434)

$290,000,000 NEW TAX ASKED OF INDUSTRY

These are the tax recommendations made by Secretary Houston which are of special interest to the automotive industry:—

1. Increase of the sales tax from 5 per cent to 10 per cent, which, it is estimated, will make an increase of	$100,000,000
2. A Federal license of cars based on 50 cents per hp.	100,000,000
3. A consumption tax on gasoline at 2 cents per gallon	90,000,000
4. The truck sales tax will be continued at 3 per cent, despite efforts to have it eliminated	
New taxes from industry	$290,000,000

Organizations Will Confer on Program

General Sentiment Favors Sales Tax—N. A. C. C. Formulates Plan of Action

NEW YORK, Feb. 14—Efforts are being made to bring together all branches of the automotive industry for concerted action in opposition to proposals for levying additional Federal taxes on motor vehicles. The impression has gained ground here that there was little probability of serious consideration being given by Congress to the proposals made by Secretary of the Treasury Houston along this line but it is becoming evident that an additional burden will be placed upon the industry unless there is a determined stand against having the automotive industry made the taxation goat.

The tax committee of the National Automobile Chamber of Commerce already has evolved a plan for presentation to the ways and means committee of the House at the special session which probably will be called for March 14. Taxation will be the most important question considered at that session and the hearings on this subject will begin in April. The recommendations of the N. A. C. C. were made after consultation by the committee with financiers and economic experts.

The program outlined calls for relentless handling of the pruning knife in government expenditures and points out ways in which $1,000,000,000 could be saved. The committee contends that if this amount were eliminated from government expenditures, no additional taxation would be necessary, but if further funds were required, they should be obtained by a tax of 1 per cent on all retail sales.

Will Seek Wide Endorsement

This program has not been approved by any other automotive organization although nearly all of them are in favor of some kind of a sales tax. It is the plan of the N. A. C. C., however, to ask every chamber of commerce in the United States to endorse the plan it has formulated or propose a program of its own and every effort will be made to arouse sentiment in favor of a sales tax.

This form of taxation already has been commended by various organizations as well as by prominent bankers and economists. The chief objection to it is that it would be paid by the ultimate consumer and many unscrupulous dealers would use the excuse of a 1 per cent tax to add several times that amount to retail prices. This consideration may weigh

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Ford Reorganization Assumes Form

Campbell Probable Choice as Treasurer

Sorenson Mentioned as General Manager—Bankers Discredit Company's Independence

DETROIT, Feb. 15—Shifting of the proposed line-up of the reorganization at the Ford plant puts W. R. Campbell in the office of treasurer. While there is no official confirmation of this report, a statement made to AUTOMOTIVE INDUSTRIES to-day by Campbell, the first he has made since he was asked by Henry Ford to accept the general managership, virtually was an admission he would assume the office of treasurer.

Campbell has been in nominal control at Highland Park for a month and has been at the plant all of every day during the period "simply helping to get things straightened out and in shape for quantity production when the plant starts," as he expressed it.

Although Campbell declined when the position of general manager was offered him, Ford would not accept his refusal and used his persuasive powers to such good effect that Campbell is thought to have given in and Highland Park officials declared it certain he would succeed to that end of F. L. Klingensmith's duties with the office of general manager, also held by Klingensmith, given to some other official.

The new alignment is believed to mean that Ford will act on his first impulse and give the position of general manager to Charles E. Sorensen, now in charge of the Dearborn and River Rouge plants. Some persons still contend Ford will go outside the organization to get a new general manager but the feeling among Highland Park officials is that Sorensen will be named.

Statement Promised Next Week

At any rate, details regarding organization, personnel and plans are promised by Campbell the latter part of next week. Campbell, who is regarded as one of the big men in the industry, has a pleasing personality, is easily approached and accessible when not surrounded by the safeguards of private secretaries and other buffers placed by Ford to ward off newspaper men and others seeking information.

Campbell talked freely although he was reticent regarding his own and the Ford company plans, explaining that his was a delicate position and that it was hardly proper under the circumstances for him to make a statement.

"I have had several propositions put to me," said Campbell, "but I have reached no definite decision. There are several things that must be done before any announcement can be made. Under the circumstances it would hardly be proper for me to make any statement regarding the company, its present operations or future plans. Mine is a rather delicate position and while I have been at Highland Park for the last month I must ask you to wait till definite announcements are ready."

Asked about the report that he would become treasurer rather than general manager, Campbell declared latter position is fraught with many handicaps and difficulties not to be encountered in any other office and added:

Campbell to Make Decision

"But I have not made any decision. I think I can promise you something official the latter part of next week when, if I accept any of the propositions presented, a statement of policies and plans will be in order."

The "relief" shift, declared by Henry Ford in an authorized interview to number 10,000, went to work at Highland Park, Monday, succeeding what he termed a like number who had been at work the two preceding weeks. The present shift will work two weeks and be replaced by the first shift, thereby giving 20,000 employees work two weeks each month pending full resumption.

Reports persist that the alternating shifts aggregate not over 5000 each but no official will make a statement, referring all inquirers to Ford's authorized interview, the only feature of which, aside from the cowless milk theory and the reiterated statement that he does not want borrowed money, was a paragraph outlining the alternating 10,000 shift plan. Officials will not say how the men are employed or the amount of production, if any, but the best information is that the force is working exclusively on parts for dealers rather than building for the assembly line. The Highland Park office is practically cleaned out even to stenographers, clerks and office boys.

Guides also have been eliminated and many Detroit visitors seeking opportunity to go through the big plant are disappointed at their inability to secure admission.

"Why Doesn't Plant Operate?"

Despite Ford's statement that he does not need money, representatives of Eastern financiers continue to visit Detroit and presumably confer with the manufacturer. Local bankers only smile when reference is made to Ford's statement of financial independence. If prodded they ask, "Why doesn't the plant open if 67,000 cars were sold in January as stated in his interview, for at same ratio it will be but few weeks before the supply on hand is exhausted?"

Seiberling Urges Stockholder Support

Says Goodyear Will Show Profit for Year if Financing Is Consummated

NEW YORK, Feb. 15—A special meeting of the stockholders of the Goodyear Tire & Rubber Co. will be held in Akron on March 4 to act on the plan for recapitalization and readjustment of the company's finances. In a letter to stockholders, urging them to attend the meeting, President F. A. Seiberling says:

"The plan for readjusting the debt and capitalization of the company has been approved by the Board of Directors and already many of the largest creditors and holders of a majority of common stock have indicated their assent to it.

"As will be seen from the statement of the company's indebtedness set forth in the plan, the position of the company is exceedingly precarious. Since the annual statement of Oct. 31, 1920, the company's indebtedness (including contingent liabilities, most of which will have to be met) has increased to nearly $66,000,000.

"Notwithstanding the discouragements of the early months of the current fiscal year, it is expected that if the plan is consummated, operations of the recapitalized company for the remainder of the fiscal year will show a considerable margin of profit over all fixed charges, including contemplated sinking funds, and over dividends on prior preference stock."

In the last analysis it will be the merchandise creditors who will determine the fate of the Goodyear company. If they accept the plan a receivership will be avoided, but if they fail to do so, it probably will be inevitable. A letter sent to them by the merchandise creditors' committee says:

Plan Holds Better Promise

"Financial difficulties of Goodyear Tire & Rubber Co. have been generally known for some time. When the merchandise creditors' committee was appointed late in December of last year a receivership was imminent and seemed inevitable, and it has thus far been avoided only with great difficulty. After a thorough canvass of the situation, the committee is advised that the present plan is the only available method of avoiding a receivership, and that a receivership would cause great delay and hold out no promise of as favorable an outcome for the creditors."

It is understood that Goldman, Sachs & Co. and Dillon, Read & Co. have agreed

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McCord Management Taken by Creditors

Schlack to Conduct Affairs of Company Under Committee —Will Extend Claims

DETROIT, Feb. 12—Joseph D. Schlack, former vice-president of the McCord Mfg. Co., has been named general manager to operate the concern by an advisory committee of creditors named yesterday. L. M. Hamlin, present secretary and treasurer of the company, will continue in that capacity. President A. C. McCord and his brother will retain membership on the Board of Directors, but will relinquish their salaries and will have no voice in the management of the company, other than as board members acting under instructions of the advisory committee.

Approximately 100 merchandise creditors and representatives of a half dozen banks attended the meeting yesterday and subscribed to the agreement submitted by a committee of bankers and larger creditors, which contemplates operation of the concern pending adjustment of financial difficulties. The agreement provides that all claims of the company will be extended six months with privilege of renewal for a similar period, all claimants to be given notes bearing interest from the date the agreement becomes effective. The period of extension is a matter entirely in the control of the advisory committee, which has authority at any time and for any reason to declare a claim due.

The committee named is as follows:

L. H. Jones, Detroit Copper & Brass Co.; A. B. Seelig, Michigan Copper & Brass Co.; A. White, Pratt & Letchworth, Montreal; C. H. Harris, of C. H. Harris, Inc., New York; H. S. Hayden, of Hayden-Westcott Lumber Co., representing the merchandise creditors, and Ralph Van Vechten, Continental and Commercial Bank, Chicago; F. G. Smith, First & Old National Bank, Detroit; Walter Dunham, Dime Savings Bank; Averill Tilden, Merrill Cox Co., Chicago, and John Fletcher, Fort Dearborn National Bank, Chicago, representing the banking creditors, with Fletcher as chairman of the committee.

Officers Under Committee

Under the agreement officers, directors and stockholders will abide by the instructions of the advisory committee, and will perform any duties or execute any orders issued by the committee. The McCord family interests, which own 65,000 shares of no par common stock, under terms of the agreement, will transfer that stock to trustees named by the advisory committee to assure the committee voting power. Hamlin assumes the position of comptroller for the committee, the agreement stipulating that the concern be operated pending readjustment under active control of a general manager and comptroller named by the committee.

The bank creditors, under the agreement, will furnish capital sufficient to operate the plants of the company, prorating the advances among the banks, which new loans, together with payrolls and new material purchases, will constitute a prior lien against the company. The banking indebtedness is unsecured save by the endorsements of the McCords.

While all creditors represented yesterday signed the agreement, their claims have not been adjusted to market values, and that matter under the agreement is left in the hands of the advisory committee. In a statement filed by accountants approximately 20 per cent was deducted from the merchandise inventories to represent shrinkage in market values, and the committee will take similar action in arriving at credit value of claims of merchandise creditors. It was brought out at the meeting that the West Pullman unit of the company, which makes railway supplies, was the one big handicap to successful operation, that plant losing approximately a half million dollars last year, while the other plants of the company showed fair profits.

Declare Conditions Hopeful

The drain caused by the West Pullman losses, together with dividends paid by the company, are held to be responsible for conditions, which, Chairman Fletcher declared, were found to be such ten days ago as to make quick action imperative. Fletcher said, however, the company's condition was not such as to cause serious concern if co-operation of the creditors could be secured, and added that the McCords had been in every way fair throughout all proceedings and very willing to abide by any suggestion the bankers made looking to a fair and equitable adjustment of difficulties.

It was announced by Fletcher that the West Pullman plant now is closed, and that steps looking to the disposal of that unit would be taken immediately. The Racine unit, which builds bodies, and the radiator and axle plants in Detroit are in good condition and have shown profits right along, Fletcher said.

The company's banking and merchandise liabilities amount to approximately $5,000,000, divided about evenly between banks and manufacturers. All of the creditors showed willingness throughout the meeting to co-operate in any way to bring about a fair adjustment, and the feeling was apparent that the McCords were taking the only fair and reasonable course for protecting all concerned.

RECEIVER TAKES SUBSIDIARY

SANDUSKY, OHIO, Feb. 14—H. R. Greenlee, receiver for the Erie Tire & Rubber Co., has been appointed receiver for the Sandusky Land & Building Co., to which the tire company advanced out of its treasury more than $300,000. The receiver was given authority by the court to complete two large apartment houses started by the land company. The tire company owns 95 per cent of the stock of the building company.

Fort Wayne Creditors Ask Receivership

Charge Heavy Shrinkage in Assets of Company — File $110,000 in Claims

FORT WAYNE, IND., Feb. 14—The reorganization of the Fort Wayne Tire & Rubber Co., which has been proceeding for several months after the election of new directors and the elimination of contracts held by the promoters who formed the company, has received a setback through the filing of three suits on account, demanding $110,000 and asking for the appointment of a receiver for the company.

The plaintiffs and the amounts of their claims are as follows. Jenckes Spinning Co., $60,000; Fred Stern & Co., $48,000; Majestic Tire & Rubber Co., $3,000. The complaints recite the history of the company and declare that after the recent reorganization was completed the creditors agreed to an extension of credit until Jan. 31 to permit the new management to raise $250,000 among the stockholders to meet the company's immediate obligations.

The complaint states that so far this has been unsuccessful. The complaint further states that a recent audit showed $200,000 in fixed assets, real estate, etc., $200,000 in material, and $45,000 in accounts receivable, making total assets of $445,000. The liabilities were then established at $275,000.

The petitioners set out that the accounts receivable shown in this audit are uncollectable, that the value of the plant and real estate has decreased through lack of a market and is worth only $100,000, and that the material on hand has decreased to a total value of $125,000, making the total assets at present but $225,000. The charge is also made in the complaint that the new management, in its efforts to obtain funds, sold the company's products below cost, and by introducing the "flying squadron" method in manufacturing, produced tires at a cost in excess of their value on the market.

FINANCE COMPANY FORMED

MILWAUKEE, Feb. 14—The Automotive Finance Corp. of Milwaukee is the name of a new corporation organized under the laws of Wisconsin to handle motor car, truck and tractor securities, notes, etc. The initial capitalization consists of $100,000 preferred stock and 500 shares of common stock without par value. The incorporators are T. J. Maher, William J. Sarres and Leonard M. Broenen, Milwaukee.

NEDOMA-NAJDER CHANGES NAME

NEW YORK, Feb. 14—The name of the Nedoma-Najder Motor Syndicate has been changed to the Nedoma-Najder Patent Syndicate, and new offices have been opened at 299 Broadway.

Extension on Claims Sought for Willys

Committee Outlines Advantage of Co-operation — File Claims Against Chrysler Plant

NEW YORK, Feb. 15—Creditors of the Willys Corp. have been asked for an extension on their claims until May 1. A letter outlining the position of the company and urging that the extension be granted has been sent out by the committee headed by Theodore Beran of the General Electric Co., which represents merchandise and construction creditors. This committee will co-operate with the bankers' committee, which has taken charge of the company's finances.

The letter states that the company is solvent and has very substantial assets in excess of liabilities. The abnormal industrial conditions which have prevailed for the last few months have made it impossible to arrange new financing. The committee recommends that claims be deposited with the Bankers Trust Co., which is the official depository.

When a sufficient number of claims have been deposited to make the plan effective, it is proposed to give a three months' extension in which to pay the indebtedness and where this indebtedness is represented by acceptances the creditors are expected to authorize the committee to take new acceptances maturing May 1. The company has informed the committee that it hopes to be in a position before that time to make a definite settlement of claims with creditors. The proposed agreement provides that no further extension shall be given and no settlement made at less than the amount of claims in cash without first submitting the offer to the creditors.

A considerable number of the creditors claim the right to file mechanics' liens against the plant now nearing completion at Elizabeth, N. J. The committee has retained lawyers to file liens on behalf of creditors who deposit their claims. When these claims are filed, the committee may agree with the company to extend the time for the enforcement of them beyond May 1.

Unwise to Force Claims Now

The letter says the committee is convinced it would be most unwise to attempt to force claims at this time. Any attempt by one creditor to obtain a preference would necessitate action by the other creditors. This, in the opinion of the committee, would have a very disastrous effect upon the value of the assets and would be most harmful to the industry in general.

The letter states that the committee will examine the assets and commit itself to no definite policy until the facts have been studied, but it has been advised that the creditors ought to receive payment in a reasonably short time.

WILLYS CORPORATION BALANCE SHEET SHOWS TOTAL ASSETS OF $53,694,153

NEW YORK, Feb. 15—Following is the balance sheet of the Willys Corp. as of Nov. 30, 1920:

CURRENT ASSETS		
Cash	$2,330,595	
Securities of other companies, including 739,866 shares of the Willys-Overland Co., valued at $8 per share	10,680,321	
Notes and accounts receivable	4,281,827	
Inventories	8,572,470	
Miscellaneous	301,024	
		$26,166,237
CONTINGENT ASSETS		
Equity in book value of securities at present market value	$11,059,279	
Good will and patents	890,134	
Redemption fund, including preferred stock, land, bldgs. and equipment	$18,279,080	
Less reserve for depreciation	2,700,577	
	15,578,503	
		27,527,916
Total assets		$53,694,153
CURRENT LIABILITIES		
Accounts payable	$2,958,445	
Notes payable	11,450,000	
Accrued accounts payable	234,152	
Dividends payable	4,075	
Miscellaneous	23,848	
		14,670,520
DEFERRED LIABILITIES		
Scrip dividend on first preferred stock	$298,000	
Reserve for taxes	347,294	
Premiums on preferred stock	23.290	
Capital stock outstanding, (first and second preferred and common)	38,355,049	
		$39,023,633
Total liabilities		$53,694,153

Reynolds Receiver Makes 20 Cent Offer

MOUNT CLEMENS, MICH., Feb. 15—An offer to pay all creditors of the Reynolds Motor Truck Co. 20 cents on the dollar of their claims has been submitted to them by Charles J. Reimold, the receiver appointed in Superior Court. The receiver has notified all creditors to file their claims within 90 days and that the assets will be distributed as soon as practicable after that date without reference to claims not proved when dividends are made. The creditors' committee headed by Harry S. Graves, which sought unsuccessfully to have a co-receiver named, has not yet decided upon the advisability of petitioning the company into bankruptcy.

BEARINGS COMPANY RESUMES

WORCESTER, MASS., Feb. 15—Receivers for the Massachusetts Oilless Bearings Co. have resumed operations in the wood bearings department and are rapidly completing uncancelled orders and taking on new work. Their operations have been interrupted because the safe containing the records of the company has not yet been recovered from the wreckage of the Knowles building in which their offices were located and which was destroyed by fire on Jan. 19.

Revere Seeks Funds To Continue Plant

LOGANSPORT, IND., Feb. 14 — Stockholders of the Revere Motors Corp. have elected a new board of directors to devise ways and means to place the company on a solvent basis by the floating of a bond issue. The company now is in the hands of a receiver in a friendly suit brought by U. S. Hoffman and Charles Hanna, stockholders.

The new directors elected are C. C. Bishop, Charles Young, A. L. Jones, M. L. Fansler, A. A. Seagraves, Edward W. Kelly and E. F. Metzger. They propose to issue first mortgage bonds to the amount of $250,000. The indebtedness of the company at present is given as $217,000, and several suits are pending against it for breach of contract. About 75 per cent of the stockholders are residents of Logansport. It is believed that if a bond issue can be floated the company will be re-established on a firm basis.

TO PAY PATHFINDER CLAIMS

FRANKFORT, IND., Feb. 15—Creditors of the Pathfinder Motor Co. of America have been notified by Harry C. Sheridan, referee in bankruptcy, that a final dividend of approximately 20 per cent will be paid them on Feb. 24.

Packard Under Way With 1000 Employees

Non-union Workers Replace Strikers in Body Plant—Sales Show Increase

DETROIT, Feb. 14—Approximately 1000 employees among those laid off at the Packard plant, Jan. 30, returned to work Friday. No discrimination is being made as to married men or men with dependents, employment officials simply notifying the men needed in various departments to again get the plant under way.

The men on strike in the painting and trimming room in the body department still are out, but sufficient non-union workmen have signed up to assure steady operation of that department permitting of resumption in other divisions. Packard officials also said many men who had been members of the union had given up their cards and signified their desire to get back on the job.

Announcement of the reopening of the plant was made in the following formal notice: "Packard Motor Car Co., simultaneously with declaration of the regular dividend of 1¾ per cent to preferred stockholders, announces to employees that increases in sales and great improvement in spring business is responsible for a decision to put on 1000 employees immediately."

About 3000 men were laid off when the plant went down, and while Vice-President Roberts expressed hope of resumption in ten days, employees were informed that the shut-down might last thirty days. The action was taken, Roberts said, to permit of balancing inventories. The announcement to-day disposes of rumors that the March dividend would be passed.

Sinclair to Sell Its Motorcycle Business

NEW YORK, Feb. 14—Sidney S. Meyers, general counsel of the Motor and Accessory Manufacturers Association, has been informed by Charles Margerum, trustee in bankruptcy for the Sinclair Motors Corp., that an agreement has been entered into with a firm of New York attorneys, under which the assets of the company applying to the manufacture of motorcycles, together with the property in the Springfield plant, consisting of equipment and machinery, will be held intact until April 21 to permit the attorneys to submit an offer for the purchase of the assets or settlement with the creditors. The terms of this offer have not been made definitely, but it can be stated an effort is being made to interest capital in the reorganization of the motorcycle business.

Margerum stated that this offer, together with the funds which will come in from the sale to the Winther Motor Truck Co. of a Government contract for the manufacture of seventy-five Militor trucks, will be sufficient to permit payment of about 30 cents cash on the dollar to the Sinclair creditors and 70 cents on the dollar in second preferred stock in a new corporation which will be formed to take over the motorcycle business. Sinclair will get $90,000 for the transfer of the truck contract together with the dies, tools and materials owned by the company.

Margerum has been authorized to effect a compromise with the Knox Motors Corp. by an entry of judgment for the plaintiff in seven replevin suits pending in Superior Court. There are now on hand sufficient funds to cover the claims of workmen for wages for the week ending Oct. 9.

Oneida Official Finds Truck Outlook Better

GREEN BAY, WIS., Feb. 14—On his return from a month's business trip through the Pacific Coast region, Lafayette Markle, president and general manager of the Oneida Motor Truck Co., Green Bay, Wis., reported a most encouraging condition in respect to the motor truck market. Markle and his assistant, J. E. Johnston, established Oneida dealers in a number of the principal cities of California.

"California is one of the best fields in the world for motor truck manufacturers," said Markle. "It is an all-year-round market. The business men are enthusiastic over the truck. Fine roads and climate make it possible to use the commercial as well as passenger car twelve months in the year. In one instance motor bus lines put out of business a 50-mile railroad running south out of San Francisco. Figures compiled from sales sources show that the average sale of trucks in southern California alone is between 550 and 600 trucks every month. Organization of new bus line companies, enlarged operations in power development, road construction and general freight and passenger traffic call for a large number of new trucks.

It was announced upon Markle's return that the Oneida company will soon place in quantity production a new type of light truck designed for the needs of farmers and business men. Up to this time the Oneida truck has been built in sizes from 2½ tons upwards.

CREDITORS SUE SANDOW

BOSTON, Feb. 11—A creditors' petition in bankruptcy was filed to-day in the United States District Court against the Sandow Motor Truck Co. of New England, with claims against the company of $61,642. Creditors are the Commercial Finance Corporation of Boston with a claim of $39.986, and the Detroit Auto Radiator Co. of Boston with a claim of $16. The petition alleges that at a special meeting of stockholders held Feb. 7 it was voted that the treasurer of the company, S. D. Griffiths, express in writing the company's inability to pay its debts and its willingness to be adjudged bankrupt.

Pierce-Arrow Ready to Resume Schedule

Factories Completely Reorganized to Manufacture New Models—Will Employ 5000

BUFFALO, Feb. 11—Completion of the vast amount of work preliminary to the establishment of regular production schedules for its new passenger cars and truck models was announced yesterday by the Pierce-Arrow Motor Car Co. Both passenger cars and trucks have been produced in a limited quantity during the last few months, the work of preparation for normal production progressing simultaneously.

"Few appreciate the enormous amount of detailed planning and physical work necessary to rearrange a big factory, install new machinery and produce new tools, dies, jigs, templates and other essentials required when new motor car and motor truck models are launched," said George W. Mixer, president of the company.

"This work requires a large force of men, and for that reason a large payroll was maintained by the factory during the last few months when other plants have found it necessary to curtail or to shut down."

The task of preparation having been accomplished, says Colonel Mixer, the company has effected a readjustment of its factory forces. About 500 who have been engaged in work of preparation are being laid off, but the bulk of the factory force, numbering 5000 workers, will continue regular production.

Interlocking Creditors Request Liquidation

AKRON, Feb. 11—Complaints of creditors of the Interlocking Cord Tire Co. that the affairs of the company were hopelessly muddled and asking for the appointment of a permanent receiver that the affairs of the company may be liquidated at once, will be heard by Judge Wright on Feb. 28. He has instructed that a meeting of the company's 5000 stockholders be held before that time to consider the situation.

Through this action the creditors and 400 stockholders who originally petitioned for the appointment of a receiver, practically abandon all plans for a reorganization of the company. The creditors asking the liquidation of the company hold claims aggregating $120,000. The officers of the company are under indictment for alleged violation of the Ohio blue sky laws.

FORD-CAMBRIDGE REOPENS

BOSTON, Feb. 11—Operations have been resumed in all departments of the big Ford Motor Co. assembling plant at Cambridge. The plant has been closed following the closing of the parent factory in Detroit.

Iowa Stages Show to Break Depression

Gradual Liquidation of Crops Expected to Start Buying—Many Cars Warehoused

SIOUX CITY, IOWA, Feb. 14—Automobile, truck, tractor and accessory dealers opened today their first show in four years—a show which is expected to revive, in a measure at least, a business which has been virtually dead since Ford cut his prices last September. In fact, sales here have been all but negligible since April, 1920, when the tightening of bank credits began, but the Ford price-cut proved the cap-sheaf of a steadily rising wall of sales resistance, which has reduced country dealers to the state of garagemen, storekeepers, bankers or whatever they were before they undertook automobile agencies, and which has forced dealers in the city to live on the profits of 1919 and early 1920.

It seems incredible that this richest agricultural center of the country, marketing point for a large area of wonderfully fertile lands in Iowa, Nebraska and South Dakota, could have suffered such a business depression, but it has. The trouble lies in the sharp decline of farm produce prices, weakening the farmer's buying power and creating a resentment against the slower trend downward of other prices which has virtually taken the farmer out of the market, and in the withdrawal from this territory of millions of dollars which the overprosperous farmers, merchants and wage-earners—and even some of the bankers—invested during the boom period in stocks which are now worthless, or nearly so.

There were some local promotions which absorbed huge sums of local capital—for instance, a packing plant which is now in receiver's hands—but much of the money invested in securities whose promoters promised big dividends has gone East or West with the promoters, who lost little time in seeking climes which would be healthier—for them. The money is gone, $200,000,000 from Iowa alone, it is said here, and another harvest will have to be marketed before anything like normal conditions can prevail.

Bank Loans Due March 1

There is prospect of some improvement in the situation after March 1, when banks generally are calling farmers' loans long overdue, thus forcing the agricultural community to disgorge last year's and even some of the 1919 crops stubbornly held in hope of higher prices. The crop liquidation movement is now under way, proceeding about as fast as the elevator men can handle it, and it is on this break in the tight money wall that the automotive men are pinning their faith—and holding a show to exhibit their faith to the community.

Dealers here do not see any possibility of big business this year and this is why: First, they must move a considerable stock of goods in warehouse, a stock which some manufacturers forced into the territory even after the then slow sales came to a complete halt in September. Then they must combat an organized movement of farmers not to buy—anything. Farmers are organizing to use each other's machinery in turn, which necessitates the most vigorous sort of sales effort by the tractor and implement men.

Crops Fail to Pay Rent

The farm situation is something like this: The renter, who depends on his crops to pay the landowner, got a price so low, if he sold at all, that he couldn't pay his rent or his grocery or garage bill or his loan at the bank on machinery or seed. The farm-owner, in many cases, bought stock which is paying no return or took part in the frenzied land speculation which inflated values from $200 to $900 an acre.

The farmer borrowed from the bank to buy the stock or the land, giving notes on his outright holdings. He hasn't paid the bank either, in many cases because he refused to raise the money by selling at forty cents corn which he planned to sell at $1.40 when he borrowed and spent the money he was going to get for his crops. The result is no money to loan in the country banks or in the city banks to which they are tributary, and the final result of all this is business stagnation.

But big business men here, including some of the automobile men, are counting on the farmer to come back into the market when he sees the 1921 crop breaking through the ground. With the banks pressing him to take up his notes, it is believed that the natural inclination to sell the old crop when the new one begins to grow will be in evidence, that the farmer will accept his loss, forget some of his resentment and buy some of the things he needs and wants.

In the used-car field there is no market and dealers have some stocks. Low-priced cars, like used cars, are in low demand, too, because it was the renters largely who bought them. And the higher priced car field has to face the opposition of bankers who have repeatedly threatened to force payment on a farmer's notes when the word got around that the farmer was going to buy a car. It has happened even in cases where a farmer worth $100,000 owed the bank only $20,000, but the bank needed the money, and the farmer, who would have sold $2,000 or $3,000 worth of produce, even at a sacrifice, refused to let go $20,000 worth—still hoping for higher prices—so he bought no car.

Potential Trade Large

However, there are in this territory thousands of rich farmers, elevator men, live-stock men and merchants, men who are rich in the huge profits of the war period, despite their losses of the past ten months. Dealers in cars, trucks, tractors and accessories are going to sell to them and get a fair volume of business until the next harvest sets this country on its feet again.

Favorable Influences Help Trade in South

Atlanta Reserve Bank Finds Return to Stable Conditions Well Under Way

ATLANTA, Feb. 12—The most recent report of the Federal Reserve Bank of Atlanta for the Sixth Reserve District, which comprises most of the Southeastern area, indicates a gradual improvement in virtually all lines of business throughout the district, officials of the bank declaring that this fact may be taken as evidence that the period of depression and readjustment has passed and that the return to normal, or what might be better termed a more stabilized condition, is under way.

Numerous manufacturing plants throughout the Southeast that have been shut down for several weeks, some of them for months, have resumed operations since the first of the year and this, too, is indisputable evidence that business is improving. The reopening of numerous textile mills in the South will undoubtedly have a favorable effect on the cotton market, and it is already noted that the price of the South's greatest product is beginning to climb.

This, in turn, will have its effect on the automobile industry in this section and will greatly stimulate sales when cotton prices have climbed back to a reasonable figure.

Atlanta dealers continue to enjoy what can be termed a fair volume of business. As compared with November and December of 1920, the total volume of January business among Atlanta dealers was very good, though, of course, considerably below normal. The increase in business experienced during January is taken by the dealers to mean better things to come and continual improvement from now on.

Spring Weather Helps Move Milwaukee Cars

MILWAUKEE, Feb. 15—The glutted condition of the used car market is gradually being overcome by the vigorous efforts of dealers, which have been supported by a natural advantage of spring-like weather, especially during the last week to ten days. Attention, of course, is also being given to merchandising new cars, but primary consideration is directed at used vehicles to prevent any further accumulation, inasmuch as from 70 to 80 per cent of purchases of new cars are involving trade-ins.

Climatic conditions all winter have been wholly unusual in being extremely mild, and if this condition continues until spring arrives by the calendar, it is felt that the usual seasonable demand will be not only advanced considerably but assume excellent proportions. When people talk of "spring fever" in the middle of February, the psychological attitude necessarily is advantageous to the trade.

Italian Factories Increase Exports

Fiat Creates Production Record in December — Communist Movement Loses Ground

TURIN, Feb. 5 (*Special Correspondence*)—All trace of the Communist movement of last September in the Italian automobile factories has now disappeared, and work is being carried out in every case under the old management and with more vigor than ever. The Government decree fixing the appointment of joint shop committees does not appear to have made any appreciable change.

The committees exist and are recognized by the employers, but they have not been the means of giving the workers any real power in the control of the works. The present arrangement is only temporary, and a more permanent scheme is being prepared. The claims of the extremists for power to decide the condition of contracts, to make purchases, and to determine the rates of wages have all been abandoned.

General conditions in the industry appear to be much more favorable than in other European countries, which is doubtless owing to the fact that Italy has a substantial export business and is able to hold foreign markets at the present by reason of her rate of exchange. At the Fiat factory, which is the biggest in Europe, it is declared that the month of December showed a record output for the year, 70 cars per day being maintained for the entire month. Probably 85 per cent of these were sent abroad.

Fiat is pushing forward work on its new 5-story factory at Lingotto, which was begun during the war. This is by far the biggest factory devoted exclusively to automobile production in Europe. At the present time only the forges, forming an addition to this factory, and the body shops are in operation, all other work being done in the old factory.

Trucks and Tractors Dull

Fiat is working principally on passenger cars, for the truck market is very dull and there is also a slackened demand for agricultural tractors.

A few months ago the Ansaldo company, one of the biggest general engineering concerns in Italy, produced a light 4-cylinder overhead valve job, designed for economical production. This is being built in Turin, and although a few have been put on the market, there are no indications that Ansaldo is going to spread to any extent in this business. The intentions of the company are not known, but it would appear that the present is not considered a suitable time for coming into competition with existing and well established firms. The Spa company, which is specializing on two high-class models, is under the financial control of Ansaldo.

Lancia is continuing work on his 4-cylinder model and is maintaining his output. A year ago he exhibited a high-class 12-cylinder job, and promised deliveries for the middle or fall of 1920. Changed conditions, however, have decided him to hold back the 12, for the market for this class of car has shrunk and production costs have considerably increased. Isotta-Fraschini has got into production on the high-class 8-cylinder in line exhibited at the recent show.

Maxwell Merger Plan Opposed in New Suit

WILMINGTON, DEL., Feb. 16—Charles J. True, a resident of Illinois and owner of 400 shares of the first preferred stock of the Maxwell Motor Co., has filed a petition in United States Court here for the appointment of a receiver and an injunction against the consolidation of the company with the Chalmers Motor Co. A subpoena was issued returnable March 7.

Minority Action Expected

NEW YORK, Feb. 16—Filing of a minority stockholders' suit against the Maxwell company occasioned little surprise here because it had been expected for several weeks that such action would be taken. A considerable amount of the stock has not been deposited under the reorganization plan. It is not expected that the courts will grant the petition, for it would militate seriously against the success of the merger.

W. R. Wilson May Head Maxwell Combination

NEW YORK, Feb. 16—Dwight E. Lee, general manager of the Motor Products Corp., left for the East to-day. One of the purposes of his trip is to confer with the Maxwell-Chalmers management committee on the question of taking charge of production for the corporation. The subject has been broached to him before, but it is understood he is not eager to accept.

Another man who has been suggested for the position is W. R. Wilson of the Irving National Bank, New York, who formerly was connected with Dodge Bros.

While reorganization of the personnel of the Maxwell-Chalmers combination is being given serious consideration by Walter P. Chrysler, chairman of the management committee, no announcements have been made, and it is understood here several weeks may elapse before a selection is made.

Franklin Production Back to 100 Per Cent

SYRACUSE, Feb. 14—H. H. Franklin Mfg. Co. resumed production at 100 per cent capacity on Feb. 10, employing approximately 300 persons. Orders for January delivery exceeded January production by 15 per cent, and on Feb. 1 the company had on hand 426 unfilled orders. Price increases of from $100 to $150 will become effective March 1.

Dunlop Deprecates Stability Attacks

Takes Steps to Protect Interests in American Company—To Raise New Funds

(*By cable to* AUTOMOTIVE INDUSTRIES)

LONDON, Feb. 14—A meeting of the stockholders of the Dunlop Rubber Co. yesterday was largely attended. There was much interest in the proceedings, and an amicable feeling prevailed at the end. Irish stockholders insisted on the protection of their interests but they were satisfied with the promise of F. A. Szarvasy, temporary chairman of the board, that the assets were more than sufficient at the present time to meet liabilities and to pay all stockholders twenty shillings on the pound.

Szarvasy deprecated reports that the company was in a serious position. He said some of the recent offering of 3,000,000 pounds sterling in stock was subscribed for by persons who were without adequate resources and who had to realize on their purchases indiscriminately. It is the apparent intention to raise 5,000,000 or 6,000,000 pounds by the sale of debentures.

Stockholders were informed proposals for financing the American Dunlop Co. could not be carried through, and it was decided to remit the sum of 806,000 pounds to avert a receivership and give time for further negotiations. A committee of the directors went to America to arrange a bond issue of $6,000,000 and safeguard the position in America, but further working capital is required. It was the original intention to issue bonds for $12,000,000 or $14,000,000 to redeem bonds and provide working capital.

Reports indicate that the American business ought to prove a big success. If the parent company had not taken the steps it did, the alternative would be to abandon interest in it and to risk the acquisition of the United States factory by rivals with the right to use the Dunlop name. The meeting authorized the directors to guarantee payment of bonds and to increase the preference share interest.

The press indorses the action taken as the best way out of an uncomfortable position, and characterizes it as a personal triumph for the tact and business ability of Szarvasy.

RAPID RIM PETITION FILED

FORT WAYNE, IND., Feb. 14—Petition has been filed in the local Federal court before Clerk T. J. Logan to have the Rapid Rim Co., of Huntington, Ind., declared bankrupt. The petition was filed by Albert L. Heinns, Henry F. Meyers and J. Archie Borland, who was formerly president of the company. It is declared in the petition that the company owes its creditors more than $100,000. A large number of Fort Wayne firms are among the creditors of the company.

Army Truck Dumping Opposed in Senate

Will Seek Allocation to States for Highway Purposes Under New Bills

WASHINGTON, Feb. 15—Strong opposition has developed in the Senate to the plan sponsored by Representative Anthony of Kansas to dump surplus army trucks, passenger cars and tractors on the open market, to such an extent that it is quite likely that the tentative legislation will fail. Three Senators have introduced separate measures having for their express purpose the transfer of this material to the highway organizations of the different states.

Senators Ball, Delaware; Norris, Nebraska, and Dial of South Carolina, have submitted bills which incorporate all the features of the Reavis bill introduced recently in the House to authorize the transfer of all surplus motorized equipment to the Bureau of Roads and the various States. Proponents of this legislation have obtained nation-wide endorsement from State officials. The Norris measure is offered as an amendment to the Army appropriation bill.

It is said that Senator Ball has undertaken a study of the situation, and, as a result, will convince the Senate of the economic advantages to be derived from transfer to various States rather than open sales. Because of the evident desire of numerous Senators to support the transfer legislation, it is probable that the Anthony rider will be eliminated before the Army bill is reported to the Senate.

The fact that three Senators representing different political parties and widely separated sections introduced three measures for the transfer of the surplus material indicates that the interest in the proposed sale of motorized equipment is national in scope. The Army appropriation bill as it passed the House and is now pending in the Senate Finance committee, directed the War Department to sell 10,000 trucks and 1000 automobiles.

Would Sell 2000 Tractors

The fortifications appropriation bill reported out to the House by Representative Slemp of Virginia, carried a paragraph authorizing the expenditure of $600,000 for alteration and maintenance of mobile artillery, including the purchase and manufacture of tools, machinery and materials and expenses of mechanics engaged in the work. But the sub-committee inserted a proviso which would make it impossible to spend this sum unless the 2000 tractors were sold. As new legislation it will be subject to a point of order when under consideration in the House late this week and may be eliminated.

Senate leaders advised AUTOMOTIVE INDUSTRIES to-day that the pressure of other legislation would undoubtedly block the consideration of the Army appropriation bill at this session. Though the President-elect has requested that the decks be cleared for taxation measures at the new Congress, it is unlikely that pending measures can be disposed of before adjournment March 4. It is learned that majority leaders are desirous of having the Army bill last on the calendar, if possible, because of the signs of a filibuster in event an effort is made to continue the House plans for selling motorized equipment.

Hicks-Parrett Tractor, Formed by New Merger

CHICAGO, Feb. 16—The Parrett Tractor Co. (wheel type) and the Hicks Tractor Co. (crawler type) have been merged into the Hicks-Parrett Tractor Co., the merger being effected so that the two types of tractors to meet differing local conditions could be manufactured in the one factory.

The company is capitalized for $3,500,000 and occupies 147,000 ft. of floor space at its factory here. The officers of the new company are Vincent Bendix, president; Robert Barbour, vice-president; George A. Gibson, vice-president and general manager; R. P. Hicks, vice-president in charge of engineering; J. E. Tracy, vice-president; Russell A. Reed, vice-president and head of the export department; Herbert L. Scharlach, treasurer; Walter J. Buettner, secretary.

The directors include Barbour, Scharlach, Tracy, Hicks, Gibson, Bendix, Warren Barbour, Henry A. Rudkin and B. A. Tomkins. The company also manufactures a line of motor trucks.

Harvester Increases Akron Truck Schedule

AKRON, Feb. 14—The Akron motor truck works of the International Harvester Co. this week started on a production basis of 150 motor trucks weekly. One order of 500 trucks for foreign shipment will be completed within the next two weeks. The company is also operating on a basis of production of 6000 thresher machine engines this year, and contemplates increasing its factory forces materially in March.

NAPOLEON ELECTS OFFICERS

TRAVERSE CITY, MICH., Feb. 11—Stockholders of the Napoleon Motors Co. at the annual meeting here elected the following board of directors: W. G. Rath, C. D. Peet, Frank Trude, E. G. Arntz, W. J. Chase, L. W. Smith and Frank Brooker. Officers remain as last year except that W. G. Rath was elected secretary-treasurer to succeed Frank Trude, and C. D. Peet succeeded W. G. Rath as general manager.

The business situation of the company was considered satisfactory with current assets more than five times current liabilities. The directors announced the payment of a 10 per cent dividend on all outstanding common stock; 8 per cent in stock and 2 per cent in cash scrip, payable Aug. 31.

Protest Increases in New York Fees

N. A. C. C. and Dealers' and Truckers' Organizations to Combat Proposed Legislation

NEW YORK, Feb. 14—At a meeting called by the Motor Truck Association of America here today at the Café Boulevard and attended by representatives of the N. A. C. C., the Commercial Truckers' Association of America, the Long Island Automobile Club, the New York State Association of Automobile Clubs and the New York Dealers' Association, besides several large individual users of trucks, such as the U. S. Trucking Corp., it was decided to form a joint legislative committee of all the associations represented and others to carry direct to Governor Miller a protest against any increase in the license fees for either motor trucks or passenger cars.

Evidence presented at the meeting seems to show that the total income from license fees in the State of New York last year totaled approximately $9,000,000, whereas the cost of road maintenance and construction amounted to only $7,500,000.

Aside from all other economic considerations which should be taken into account in regard to both passenger cars and motor trucks, the legislative committee will claim that there is no justification in raising license fees at this particularly critical period in our reconstruction, so long as the total license income exceeds the cost of road maintenance and reconstruction.

The following statement has been prepared by the Merchant Truckmen's Bureau with reference to the proposed legislation:

"The move to tax the heavy motor truck from State roads is out of line with the general policy of present-day transportation.

"The motor truck has brought outlying communities into closer touch with the metropolitan district, has served as a communicating link between cities and, under the stress of emergency, has taken up the long haul of railroads when their services, because of labor difficulty or congestion, became inadequate.

Trucks Cut Cost of Living

"The motor truck brings perishable commodities to the cities in large quantities, and, when green vegetables were held at prohibitive prices by commission merchants, it was the motor truck which went out into the country and brought in produce, forcing concessions in prices.

"The motor truck has become a part of our transportation system because it has demonstrated its ability to do certain work more economically and expeditiously than can be done any other way.

"Instead of discouraging the use of motor trucks for the preservation of roads, the motor truck should be recognized as a national necessity—a part of our transportation."

Good Roads Congress Urges Speeding Work

Exemplifies Need of Wise Expenditures in Year's Program —Available Funds Large

CHICAGO, Feb. 14—Scarcely had the doors of the Coliseum closed on the national automobile show than they swung open on the eleventh American Good Roads Congress, the eighteenth annual convention of the American Road Builders' Association and the twelfth National Good Roads Show. Some dealers who attended the automobile exhibit remained over this week, so intimate is the relationship between good roads and the industry, and the Chicago Automobile Trade Association interested itself in helping to entertain the visiting good roads delegates.

The question which confronts the road builder, it was shown from the discussions, is not where to get the money for improvements but how wisely he can spend it. It is realized that with the changed traffic conditions greater study should be given to the character of roads to be built and the kind of maintenance to be given those highways already constructed. There is a feeling that maintenance should be kept at 100 per cent, regardless of mileage contemplated.

Immediate construction on roadwork was urged. The discussion of sub-grades was one of the most important on the program.

"The crying need, as far as that need can be seen at the present time," said H. G. Shirley, secretary of the Federal Highway Council, "is to build a road that will have a uniform strength, so as to carry a specific load over its entire length without danger to its structure. We all know that on gravel soils with a high bearing power a thick surfacing will not be required, whereas on soil consisting of clay a very much thicker surfacing will be required to carry the same load certain seasons of the year. Why, then, should we persist in laying the same thickness of surfacing over the clay soils that we lay over gravel and other more stable materials? Millions are wasted annually in placing a greater thickness of material in places where it is not needed than in other places where a greater thickness is essential."

Must Show Earning Capacity

In speaking of the big program planned, Thomas H. MacDonald, chief of the United States Bureau of Public Roads, said, "Just now we have literally a pocketful of money. Funds have been made available in large amounts by the Federal Government, the States, the counties and even smaller districts which have accumulated because of non-expenditure. The earning capacity of our roads must be demonstrated, however, for we should not be hypnotized into the belief that this condition will continue to exist."

The fundamental engineering problem, MacDonald stated, was the inter-relation of the motor truck and the road.

"There is no doubt," he said, "that the design of motor trucks has been treated largely from the mechanical consideration of the construction of the vehicle itself. The development of these vehicles has taken place so rapidly that the adaptation of the vehicle to the roadways over which it is to be operated has been seriously neglected. On the other hand, the highway engineer is forced to give some consideration in his design of modern highways to the vehicles which are to be operated over them, and it is now time that the inter-relationship of the design of highways and the design of motor vehicles be recognized as a fundamental engineering problem without which the development of neither can go forward in a manner that will bring to the public the greatest service."

The Good Roads Show, which occupied the major part of the Coliseum, was given over to the display of road-building machinery, with a large number of trucks placed on view.

H. S. Berlin Elected President of Victor

SPRINGFIELD, OHIO, Feb. 15—H. S. Berlin, of Akron, has been elected president and general manager of the Victor Rubber Co. by the board of directors. The other executive officers chosen were: Vice-president, W. L. Timmons of Cleveland; secretary and treasurer, H. S. Burr, of Springfield; factory manager, Frank R. Talbott, of Springfield; sales manager, C. A. Swinehart, of Springfield. The new president and general manager has been in charge of one of the plants of the Firestone Tire & Rubber Co. of Akron, and has had extensive experience in the rubber industry. He succeeds H. H. Burr in the reorganization.

Announcement is made that orders for tires are being received by the Victor Co. in increasing volume. The factory is now running about 60 per cent on tires.

EDMUNDS & JONES SHOWS GAINS

DETROIT, Feb. 14—Profits of $108,226.01 for the year ending Dec. 31 are shown in the annual report of the Edmunds & Jones Corp. Assets aggregating $2,347,382.27 compare with $2,395,080.91 at the close of 1919. Current assets of $1,319,714.47 and current liabilities $532,746.98 compare with $1,468,791.64 of current assets and $479,733.00 current liabilities the previous year. Working capital in 1920 was $786,967.49 compared with $989,058.64 in 1919. Plant investment is given at $990,940.03, an increase from $900,558.79.

Surplus representing the book value of 40,000 shares of no par common stock after allowances for Federal taxes and deductions of dividends of 7 per cent on preferred and $2 on common was $959,409.15, compared with $1,016,997.83 at the end of 1919. Outstanding preferred was reduced from $890,400 to $843.200 by purchase and redemption, making $156,800 retired by that method.

Highway Educators Meet at Ann Arbor

Many National Figures to Address Conference—Ex-Secretary Redfield on Program

ANN ARBOR, MICH., Feb. 11—Under the auspices of the permanent committee on Highway and Highway Transport Education, the University of Michigan and the Michigan State Highway Department, a mid-western conference on highway and highway transport education will be held here Feb. 23. The program will be as follows:—

Morning session, 10:00 A. M., Auditorium, University Hall; Dr. P. P. Claxton, U. S. Commissioner of Education, presiding; "The Highway and Social and Economic Welfare," by Dr. Claxton, chairman of the permanent committee; "The Educational Activities of the Permanent Committee," by Professor C. J. Tilden, director of the permanent committee; "The Economics of Highway Transport," by Roy D. Chapin, vice-president, National Automobile Chamber of Commerce; "Highway and Highway Transport Education in Secondary Schools," by George C. Diehl, chairman, good roads board, American Automobile Association; "Safety First Education in Secondary Schools," by Harriet E. Beard, Supervisor of Safety Education, Detroit public schools.

Afternoon session, 2:00 P. M., Auditorium, University Hall, Dr. P. P. Claxton presiding: "The Measure of Highway Accomplishment," by Thomas H. MacDonald, Chief, United States Bureau of Public Roads; "The Army's Highway Transport Problem," by Col. Mason M. Patrick, Corps of Engineers, U. S. Army; "The Interrelationship of Waterway, Railway and Highway Transport," by Professor Henry E. Riggs, Professor of Civil Engineering, University of Michigan; "Snow Removal from Transport Routes," by Charles J. Bennett, State Highway Commissioner of Connecticut; "The Economic Value of Highway Transport Surveys," by Professor Arthur H. Blanchard, Professor of Highway Engineering and Highway Transport, University of Michigan.

Dinner will be served in the banquet hall of the Michigan Union at 6:00 P. M., Dr. Mortimer E. Cooley, president of the Society for the Promotion of Engineering Education, presiding. After dinner addresses will be "Highway Transport and the Industry," by Tom Snyder, secretary, Indiana Highway Transport & Terminal Association; "Interrelationship of Highway Transport and the Back-to-the-Farm Movement," by A. R. Kroh, Development Department, Goodyear Tire & Rubber Co.

At the evening session, with Dr. Marion L. Burton, president of the University of Michigan, presiding. "The Trinity of Transportation," will be discussed by William C. Redfield, former Secretary of Commerce of the United States.

GASOLINE QUALITY HIGH

WASHINGTON, Feb. 11—Improvement in the quality of motor gasoline has been reported by the Bureau of Mines after a study of samples taken from representative garages throughout the country.

Seiberling Urges Stockholder Support

Merchandise Creditors to Take Shares If Not Sold—Stock Values Improved

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to head a syndicate to underwrite the $25,000,000 20-year 8 per cent sinking fund bonds, proceeds of which will go toward paying off the bank debt. While no decision has been reached in the matter, it is not unlikely that the balance of the financing, consisting of $25,000,000 10-year 8 per cent sinking fund debentures, 250,000 shares of common stock and $35,000,000 8 per cent prior preference stock will be underwritten by another banking group. The $25,000,000 debentures, 250,000 shares of common stock and $35,000,000 prior preference stock is to be offered for subscription to existing common and preferred shareholders of the company at prices to be determined by the committees in charge of the plan, and these securities or the proceeds from their sale will be used to satisfy other claims and for other corporate purposes.

Under the plan, if none of the prior preference stock is sold, practically the entire $35,000,000 will be divided among the merchandise creditors, who are split into two groups.

One group represents creditors to whom the company's indebtedness existed on Jan. 1, 1921, and whose claims aggregate $15,395,660. They will receive 125 per cent of their claims in prior preference stock, or $19,244,575 par value.

The other group represents creditors with whom the company has made commitments for merchandise not delivered prior to Jan. 1, 1921, but for which specifications and prices have been fixed. Their claims aggregate $54,959,503, for which they will receive 75 per cent in cash, payable not later than the tenth of the month following shipment from American point of shipment, and 28 per cent in prior preference stock, which amounts to $15,388,660 par value.

Will Write Down Inventory

The company contemplates "writing down" its inventories and commitments, and converting part of the difference between the cost and market value of raw materials into prior preference stock, so that the company's earning ability may be immediately enhanced and also so as to bring nearer dividend payments.

The refinancing wipes out the company's deficit, and will enable it to operate on costs based on present market value and to resume earnings.

"While the present low market prices of our stocks do not look good to those who hold them, we feel that the value of these stocks is made more secure and the future prospects are made brighter by the plan which proposes to relieve us of the dangers of pressure by our creditors," says a Goodyear statement.

EMPLOYEES AGREE TO WAIT FOR WAGES

DETROIT, Feb. 14—Penberthy Injector Co., which has been working on a two-day week schedule, began work to-day on a five-day schedule under a deferred wage payment plan submitted by officials and accepted by employees.

Under the plan employees will be paid cash for three days each week and the balance credited to their accounts. Cash on the deferred wages will be paid on a sliding scale proportionate to the volume of business as it increases.

The plan was proposed to give opportunity to all employees to make sufficient money to maintain themselves, and to give the company an opportunity to work up its stock in materials, which is estimated to last six months. Officials of the company are confident of early improvement in business and look forward to paying the deferred wages within a few months.

Willys-Knight Output of 2 Daily Scheduled

TOLEDO, Feb. 14—The Willys-Overland Co. posted its first production schedule this year to begin to-day of two Willys-Knight sedans daily.

This schedule will keep the small force of men, about 1600 now employed at the plant, busy. Parts of the cars are already built. Men have been busy rectifying some cars in the factory for several weeks.

That the market at the present time in the whole country is just at the balance point where talk of further price reduction, new models, or other disturbing elements might set the industry back several weeks is the thought of Mr. Wilson, in charge of Overland operations.

He feels that the industry has made a move in the right direction during the last two weeks and that conditions appear to be coming right.

Industry has picked up about as much as bank clearings, three per cent. That's the general opinion of the Overland officials.

CHARLES R. STEPHENS DIES

MOLINE, ILL., Feb. 14—Charles R. Stephens, son of George W. Stephens, founder of the Moline Plow Co., and for 27 years intimately associated with the business, died suddenly Wednesday at his home in Los Angeles. Mr. Stephens had not been interested in the company since it was acquired in 1918 by the Willys interests.

He was superintendent of the plant for 18 years, a director of the company nearly as long and in later years director of the foreign sales department. He made a notable record as shop superintendent. Mr. Stephens was born in Moline, June 8, 1862.

Bosch Wage Scale Cut 12½ Per Cent

Company Takes Conservative Position on Dividends—Extension of Markets Helpful

SPRINGFIELD, MASS., Feb. 15—The American Bosch Magneto Corp. has announced a wage reduction of 12½ per cent affecting all factory employees whether on a weekly or piece work basis. Operations in the plant are being steadily increased and several hundred men are now employed.

The directors of the company will meet late this week for action on dividends and it is reported payments will be reduced. Although the company has about $6,000,000 of orders on hand it is said the directors are inclined to take a conservative position on the dividends pending improvement of business conditions.

Arthur T. Murray, president of the company, has sent out a review of the corporation's business since its inception. This shows that in 1916 sales were slightly more than $4,000,000 and that in 1918 under the old company and the alien property custodian they had fallen to $3,656,000. The sales of the new American company in 1919 were $5,982,000 and in 1920 they had increased to $8,805,000.

Murray devotes considerable attention to the taking over of the management of the Gray & Davis plant at Cambridge and its lamp factory at Amesbury under terms most favorable to the American Bosch Magneto. The product of the Bosch company is now very diversified. The magneto department is depending on the automobile trade for not more than 20 per cent of its business.

The growing demand is in the field of farm engines, tractors, trucks, marine engines and other trades in which the internal combustion engine plays an important part. The company also is equipped to enter the automotive field with battery ignition systems, starting and lighting systems, spark plugs, etc.

R. & V. MAKES WAGE REDUCTION

EAST MOLINE, ILL., Feb. 14—Wage reductions approximating 15 per cent have been adopted by the R. & V. Motor Co., affecting men in all departments and those upon a piece work basis. Employees laid off and returned to work during the period of the depression accepted the lower scale upon their return. H. A. Holder, president of the company, announcing the reduction, told employees that there is absolute necessity for readjustment of costs.

BUFFALO S. A. E. TO MEET

DETROIT, Feb. 11—The Buffalo Section of the Society of Automotive Engineers will meet at the University Club, Buffalo, Feb. 23, at 8 p. m. Ferdinand Jehle, of the Aluminum Mfg. Corp., Cleveland, will present the paper.

Industry as Whole Must Unite on Tax

Destructive Effects of Proposed Action Must Be Shown at Congressional Hearings

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can easily pay the tax and the man who has no business to run a car because of his circumstances must let go." The pernicious effect of this assumption is readily apparent when it is remembered that these views are handed out to other legislators.

The problems of the present session have been too perplexing to allow Senators and Congressmen to give adequate study to the ultimate effects of the Houston program. It will be the duty of representatives of the industry to enlighten them at hearings which probably will be held early in April. Officials of the Treasury Department already have appeared before the Senate and House committees. Senator Curtis and other leaders have stated that the books must be balanced before July, indicating that discussion of internal revenue matters will be limited and the most appealing plans will be accepted.

The Secretary of the Treasury in suggesting sources of additional revenue advised Congress that "the suggested list of consumption taxes have not been selected because their use is particularly harmful OR IN ANY SENSE LESS LEGITIMATE THAN THE USE OF ARTICLES NOT SO INCLUDED."

The Secretary has declared that consumption taxes must be considered from practical standards. Sentiment has developed in favor of the Treasury program chiefly because it affords the easiest way out of a tremendous problem. Imposing heavy taxes on a selected list would eliminate legislation for petty taxes and Congress does not intend to hunt for work. There has been considerable agitation for a sales tax, however, and the movement seems to have gained headway.

Information has reached numerous Congressmen that the automotive industry is disposed to treat the Treasury plan lightly. Legislators have stated that the most serious thought will be given the Secretary's plans because he is in a position to know the nation's needs. It also has been asserted that the proposed tax of 2 cents per gallon on gasoline at refineries would be defeated because of the influences of the oil interests but there is nothing to support this encouraging assumption.

Organizations Will Confer on Program

(*Continued from page* 424)

heavily with Congress because of the political dynamite it contains.

C. C. Hanch, chairman of the N. A. C. C. tax committee and former general manager of the Maxwell Motor Co., who has been devoting much of his time to the formulation of the tax program, expects to spend several days consulting with representatives of other automotive organizations concerning their tax ideas. Hanch and his committee have not determined whether protest against additional taxes on automobiles would carry greater weight at Washington if they were presented by the industry as a whole or by each organization separately on a different hearing date. No decision has been reached as to who will make the argument for the N. A. C. C. before the ways and means committee. Some members of the tax committee feel it should be presented by an expert on economics rather than by a lawyer.

M. A. M. A. to Discuss Action

Directors of the Motor & Accessory Manufacturers Association will consider the tax question at a meeting here Friday and it is probable a special committee will be appointed to take up the question. Sentiment in this organization is in favor of some sort of sales tax. M. L. Heminway, general manager, feels that concerted action should be taken by the industry against such a menace as heavier Federal taxes. He is willing to go to any reasonable length to bring about such action.

The tax committee of the Rubber Association of America also is committed to a sales tax but on a somewhat different basis from that proposed by the N. A. C. C. A. L. Viles, the general manager, is firmly convinced that arguments in Washington will carry much greater weight if they come from the industry as a whole rather than from different branches of it.

The National Automobile Dealers Association adopted a resolution at its recent convention in Chicago declaring that it was in complete accord with the program of the N. A. C. C. calling for the reduction of war-time expenditures by the Federal government and a return of the government to normal. Harry G. Moock, the general manager, says the two associations will work in complete harmony on the question of tax policy. He has under contemplation a plan whereby the dealers will appoint a tax committee to meet the tax committee of the N. A. C. C. and learn how the two organizations can work together.

The American Automobile Association is expected to stand with the N. A. C. C. on the tax question.

N. A. C. C. Firm for Plan

It is probable a conference of representatives of various organizations will be held in the near future to discuss the possibility of united action. It is not known whether the N. A. C. C. would be willing to modify its program if it does not meet with the entire approval of the other organizations. It has been suggested that the Motor Vehicle Conference Committee or a similar organization representing all branches of the industry might be used in future to map out action on questions which involve the industry as a whole.

Post Office to Probe Junker Plane Loss

Accident in Which Three Lives Were Lost to Be Given Thorough Investigation

WASHINGTON, Feb. 11—Officials of the Air Mail Service announced today that a thorough investigation would be conducted into the explosion of the Junker plane at LaCrosse, Wis., yesterday, which resulted in a loss of three lives. Chief of Flying Operations Collier stated that the mechanical faults which had been responsible for the destruction of other J L planes had been eliminated, so that it was difficult to determine the cause of the fatality.

The mechanicians employed by the Postal Service are unwilling to believe that it was the fault of the gas system. The wrecked plane had been completely overhauled and a new fuel feed system installed following accidents to other planes. The fuel system was known as "fool-proof." It was devised to allow leaking gas to fall to earth rather than in the fuselage and invite explosions.

The machine, J L 301, had been in service four months. The authorities have two theories to advance. Either the pilot lost control of the elevators or some difficulty caused loss of flying speed and the machine crashed to earth as a result. Reports establish the fact that there were no signs of fire before the machine was smashed.

Because of the defense of purchases of these planes made by the Postmaster-General and endorsement of their superiority over American planes, it is expected that the latest accident will incite an attack against encouraging foreign aircraft makers as against the new industry in this country.

Larsen Defends Plane

NEW YORK, Feb. 15—J. L. Larsen, sales agent in this country for Junker planes, has sent out a statement in which he asserts that the mail airplane which crashed at La Crosse did not catch fire in the air. He asserts that the machine circled twice across the landing field, losing altitude preparatory to landing, with the motor hitting perfectly, but when at an altitude of 500 ft. it nosed down for some unknown reason and crashed, taking fire after it struck.

Larsen complains that undue prominence has been given to this accident in contrast to the small space given an accident to a De Haviland on the same route a week previously when the pilot was killed and the mechanic seriously injured. He asserts that the German plane was making its first trip over the Chicago-Minneapolis mail route with men new on that line. Larsen adds that mechanical changes made by the air mail service were not in accordance with the German practice, so he is not in a position to state whether the machine was safe for flying.

Business and Sport Share S.A.E. Program

West Baden Springs Hotel Offers Unusual Facilities for Meet —To Push Researches

NEW YORK, Feb. 15—Following the custom of previous years, the Society of Automotive Engineers, at its annual summer meeting, will hold but one engineering session each day, the remainder of the time being given to sports and recreation with a series of house lectures and dancing in the evenings. The engineering sessions will be from 10 to 1 o'clock. The meeting this year is to be at West Baden Springs, Indiana.

The West Baden Springs Hotel with accommodations for 930 guests is well suited for the special meeting because of its isolation among the hills of southern Indiana. It provides every facility for golf, horse back riding, tennis, bathing and field sports as well as for summer meetings. The hotel is circular in shape, six stories high and has a glass covered central court which is the largest room of its kind in the country.

West Baden is famed for its mineral waters and mineral and mud baths, all of which are a part of the hotel system. The hotel has a large swimming pool and a complete bath equipment. Within five minutes walk of the hotel is a sporty 9 hole golf course. There are two other golf courses within five miles of the hotel.

West Baden is on the Monon Railroad, 126 miles southwest of Indianapolis and 60 miles north of Louisville. Good roads radiate in nearly all directions.

The meetings committee for 1920 under the chairman, C. F. Scott, has already drafted a comprehensive program based on one session of three hours for each subject. The opening day, May 24, will be given over entirely to standardization and meetings of the standards committee. Other subjects to be considered are aviation, farm tractors and fuel research. Research work this year will play a more important part than ever before in the activities of the S. A. E. in view of the appropriation of $30,000 which has been made to foster it.

Committee to Engage Man

During the past year the S. A. E. has worked on fuel research and this will be continued but there are many other research activities which may be carried on, among them radiator temperatures and gear tooth pressures. Additional subjects are being considered by the research committee headed by H. M. Crane.

A special research man will be engaged to handle the work under the direction of the research committee. He will be an expert familiar with all branches of research. Some effort will be made to obtain the co-operation of companies engaged in various lines of research. It has been estimated that there are as many as a dozen of these companies. It is not the intention of the S. A. E. to open a laboratory but its work will be carried on in laboratories of companies in the automotive field. Co-operation of government bureaus such as the Bureau of Standards and Bureau of Mines will be obtained as well as that of Universities and engineering schools.

Crane and his committee have not drafted any comprehensive line of research but the program will grow gradually and committees will be organized as it progresses along lines similar to the expansion of the standards committee during the past nine or ten years. Members of the committee besides Crane are E. A. Johnston, C. F. Kettering, H. L. Horning, J. G. Vincent, H. W. Alder, Dr. H. C. Dickinson, T. C. Menges, Joseph Van Blerck, and O. C. Berry.

Midwest Tire Makers Hear Cooperation Plea

CHICAGO, Feb. 15—The Midwest Rubber Manufacturers Association held its regular monthly luncheon and meeting at the Chicago Athletic Club to-day. The principal speaker was Thomas Whitehead, president of the National Tire Dealers Association, a new association formed during the Chicago automobile show for the purpose of bringing into one national organization the best tire dealers of the country.

Whitehead's remarks inspired those present with the feeling that before long every community of any size will have its local chapter, the purpose of which will be to eliminate the "gyp" method of selling tires so prevalent in the past. Whitehead assured the tire manufacturers present that an ever-ready spirit of cooperation would be found by the members of the association to bring the merchandising of tires to a higher plane than ever before but demanded that a like spirit prevail among the manufacturers to do their part in the work.

AUTO BODY SHOWS GAINS

DETROIT, Feb. 14—Assets of $2,674,906.02 and surplus of $48,035.28 are given in the balance sheet of the Auto Body Co., as of Dec. 31. Current assets were $1,515,006.50 and current liabilities $1,070,490.69 compared with current assets of $1,211,709.04 and current liabilities $714,934.39 in 1919. Working capital at the end of 1920 was $444,515.81 against $496,934.63 a year ago. Fixed assets were $1,095,329.57 against $1,090,743.06 in 1919. Outstanding preferred stock amounted to $531,500, an increase from $527,600 during the year, and outstanding common was $1,018,500, an increase from $1,017,400. Total assets for the previous year were $2,339,216.29 and surplus, $49,782.

DANIEL SOUTHERN RECEIVER

GREENSBORO, N. C., Feb. 14—Garland Daniel of Greensboro has been named as receiver for the affairs of the Southern Truck & Car Corp., large manufacturers of commercial motor trucks, the action being taken as a protection to the stockholders of the company. The corporation is capitalized at $1,000,000.

METAL MARKETS

ALMOST every new transaction in the iron and steel market, if at all representative in point of tonnage involved, records lower price levels. This successive shading of prices, however, does not denote a fresh downward readjustment of the market. It is but the consummation in actual sales of what has been a theme for abstract discussion since last November. To be still more precise, it is the beginning of this consummation. As to its culmination, there is no telling. The manner in which prices are beginning to tell the market's readjustment, is, however, no less gratifying to the seller than to the buyer. For weeks and weeks iron and steel producers found it utterly impossible to secure orders at any price. They knew this and continued to quote unchanged prices because concessions would have proved useless bait. In the last few days it has become evident that there is some business to be had, not spectacular in tonnage but actual, honest-to-goodness orders. To "land" this business, it was necessary to quote prices in keeping with the changed order of things. It was the first reawakening of genuine consuming demand and steel producers were too pleased at sight of this blossom, tender as it still is, to lose very much sleep about how sharp price cuts would have to be in order to get this business on their books. In fact, for some time the instructions of all "independents" to their sales executives have been to corral all business in sight, at whatever price it was necessary to quote. The only reason that the "independents" did not cut under the Corporation's levels before, was that there was no business to be had at any price. Press reports from the Youngstown district of sharp price reductions by one of the leading independents, were largely for the benefit of labor agitators who, otherwise, might have taken reductions in wage scales with less grace. To sum up the situation, the Corporation's prices have now become obsolete, in so far as new business is concerned. Quotations of independents are sufficiently elastic to include serious consideration of any and all bids that consumers might be tempted to make, so long as specifications are attractive.

Pig Iron.—With basic pig iron offered at as low as $25, furnace, the price of foundry and malleable suitable for automotive foundries, is problematical. Sales of the latter have been made in small tonnages at around $29, valley. Practically all of the automotive buying is in carload lots.

Steel.—Most of the buying by automotive interests consists of filling in or matching up tonnages. Fair-sized tonnages of sheets, however, are reported to be going forward from Pittsburgh district mills to Detroit passenger car builders, especially to those manufacturing medium priced passenger cars. The Reo Motor Car Co. and Buick Motor Co. are among those who have been ordering sheet shipments forwarded.

Aluminum.—Placing of orders with automotive foundries for aluminum castings is reflected in a somewhat better demand for No. 12 alloy. The "outside" market for virgin ingots, 98 to 99 per cent pure, has receded to around 24½ cents.

Lead.—The American Smelting & Refining Co. reduced its official quotation $3 a ton to a basis of 4.60c., New York and East St. Louis. In the "outside" market the New York quotation is on a parity with that of the chief interest and East St. Louis is quoted at 4.30c.

FINANCIAL NOTES

D'Arcy Spring Co. plans to increase the capital stock from $75,000 to $1,000,000. Of this amount $650,000 will be common stock and the balance of $350,000 will be 8 per cent preferred stock. Application has been made to the Michigan Securities Commission allowing the proposed increase. Up to this time the D'Arcy Spring Co. has been a closed corporation, but the new stock will be offered to the public, and it is planned to give the new shareholders representation on the board of directors. Preferred stock to the value of $150,000 will be offered first.

Knickerbocker Motors, Inc., Poughkeepsie, N. Y., has filed schedules in bankruptcy with liabilities of $200,771 and assets of $89,678 and other assets of value unknown. Machinery, etc., is valued at $16,047; accounts $72,736. and deposits in banks, $894. Among the creditors are the estate of Herbert G. Streat, $72,569; First National Bank of Poughkeepsie, $15,919, and Irving National Bank, $20,770.

Stewart Warner Speedometer Corp. reports net income for 1920 of $2,728,472, as compared with $2,331,915 for the previous year. The amount available for the capital stock, $2,210,000, was smaller than in 1919 owing to increased taxes and a large amount of stock outstanding. This was equal to $4.83 a share on the 457,525 shares, as against $4.90 on the 400,000 shares outstanding at the end of 1919.

Pierce-Arrow Motor Car Co. stockholders, both common and preferred, numbered 4730 on Jan. 1, an increase of 1210, or about 35 per cent above the total of Jan., 1920. The number of holders of common were 2880 and preferred 1850, compared with 1800 and 1720 the year before.

Supreme Motors Corp. is offering through W. A. Fennell & Co., Cleveland, $1,500,000 first mortgage 8 per cent convertible bonds due annually Jan. 1, 1923 to 1929, inclusive. The proceeds will be used to retire current indebtedness and increase working capital.

Federal Motor Truck Co. reports profits before Federal taxes of approximately $745,878.66 for 1920. Taxes are estimated at $200,000. Total sales were $10,628,742.09 Total assets are $4,525,340, and the surplus for the year $806,812.

Hill Insulating & Mfg. Corp., New York, has filed a petition in bankruptcy with liabilities of $24,161 and assets of $6,079, the main items of which are stock, $2,500; machinery, etc., $2,000, and accounts, $1,494.

Rey Wheel Co. has increased its board of directors from five to eight, adding James C. Kempton, of the Detroit Sales Co.; William Roberts, of Roberts Tube Works, and C. R. Aikman, of Amherstburg, Ont.

Packard Motor Car Co. declared the regular quarterly dividend of 1¾ per cent on the preferred stock payable March 15.

Parker Creditors Vote Confidence in Officers

MILWAUKEE, Feb. 11—Absolute confidence in the present officers and directors of the Parker Motor Truck Co. is voiced by the creditors' committee appointed on Dec. 13 which has been investigating the conditions of the corporation. It is felt that with the consent of the creditors the affairs of the company can be carried on without recourse being taken in the appointment of a receiver.

The company is a reorganization of the Stegeman Truck Co. which two years ago found itself in financial difficulties. The new company took over and assumed all accounts of the Stegeman company and has paid about 75 per cent of them.

A large amount of money was found necessary in entirely rebuilding and redesigning the Stegeman product to bring it up to its present efficiency.

Emerson-Brantingham Shows Drop in Earnings

ROCKFORD, ILL., Feb. 11—With the plants of the Emerson-Brantingham Co. operating at the present time at about 75 per cent of capacity, a moderately profitable business for this year is forecast in the annual statement of President C. S. Brantingham.

Earnings of the company during the past year were materially reduced but the company transferred $20,768 to profit and loss surplus after payment of the 7 per cent preferred stock dividend. In the previous year there was a surplus of $470,484. The income account for the fiscal year ended Oct. 31, 1920, together with the balance sheet at the end of that period, compares as follows:

INCOME ACCOUNT

	1920	1919
Op. profit, after tax	$1,512,857	$1,837,225
Other income	412,695	409,785
Total income	1,925,552	2,347,010
General expenses	*419,329	403,311
Net income	1,506,226	1,843,699
Interest	453,087	339,444
Depreciation	180,435	181,835
Net profit for year	872,703	1,322,419
Preferred dividends	851,935	851,935
Surplus for year	20,768	470,484
Previous surplus	2,542,089	2,071,605
Total surplus	2,562,857	2,542,089

*Including $176,713 loss on exchange.

BALANCE SHEET
ASSETS

	1920	1919
Property account	$8,265,364	$7,421,105
Patents, goodwill	4,614,402	4,614,403
Treasury stock	669,075	476,553
Inventories	14,545,827	11,761,034
Notes and accts. recbl	5,910,392	4,201,483
Sundry debtors, etc	.....	253,265
Liberty bonds	316,700	328,486
Cash	1,104,453	617,741
Realty and advances	27,286	43,917
Deferred charges	224,853	87,044
Total	$35,678,352	$29,865,031

LIABILITIES

	1920	1919
Common stock	$10,132 500	$10,132,500
Preferred stock	12,170,500	12,170,500
Notes payable	7,915,285	2,978,209
Accts. pay., inc. fed. tax.	1,767,726	1,008,602
Contingent reserve	1,129,484	1,003,131
Surplus	2,562 857	2,542,089
Total	$35,678,352	$29,865,031

PEERLESS REDUCES DIVIDEND

CLEVELAND, Feb. 14—The cut in the dividend rate of the Peerless Motor Car Co. is ascribed by directors to the desire of the company to protect its future interests. The cut is the second that has been made and reduces the rate to 4 per cent on the par value of $50.

Bank Credits

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, Feb. 17—The local money market eased the latter part of last week. Call money ruled at 8 per cent the first two days of the week and at 7 per cent thereafter. The range for the week was 7 per cent to 8 per cent as against 7 per cent to 9 per cent the week before. Time money was firm with a light supply. Sixty and ninety days' and four months' paper was quoted at 7 per cent, and five and six months' paper at 6¾ per cent, the same as the week previous. One of the principal causes of this firmness was, apparently, the large withdrawals by the South and the West, as indicated by the week-end bank statements.

The statement of the New York Associated Banks showed further contraction and may explain to some extent the easier call money towards the close of last week. The excess reserves over legal requirements increased $4,250,480, and loans declined $72,943,000. This is the largest reduction in loans since the second week of January.

The New York Federal Reserve Bank, in contrast with the previous week's operations, showed an improved reserve position. Gold reserves increased $10,328,000, and total cash reserves $15,167,000. Total bills on hand declined $25,198,000, and total earning assets $22,896,000. Federal Reserve notes in circulation in this district declined $8,554,000, while Federal Reserve bank notes increased $4,314,000.

G. M. C. Sales Increase; Net Profits Decrease

NEW YORK, Feb. 17—A preliminary report of the General Motors Corp. for the year 1920, issued to-day, shows a gross business of $565,000,000, an increase of $56,000,000 over the preceding year and the largest in the history of the company but the net profits of $48,262,000 available for dividends, were $11,800,000 less than in 1919. Total current assets were $263,939,000 and current liabilities $115,554,000. This left a net working capital of $148,395,000. Cash in banks on Dec. 31 totalled $49,278,000 and sight drafts, notes and accounts receivable to $48,661,000. Notes payable amounted to $72,225,000 and accounts payable and trade acceptances to $25,794,000.

The finance committee of General Motors Corp. is considering the advisability of wiping out bank loans of approximately $75,000.000 through the sale of new securities. General Motors has no immediate need for funds for any purpose other than the elimination of its loans and it is simply a question of policy whether the banks should be paid off at this time.

The company is considering sales of some of its factories and W. C. Durant is reported as having made offers.

MEN OF THE INDUSTRY

Homer Hilton, sales manager of the Oshkosh F. W. D. truck, who is leaving that organization, has been sent to Detroit to take charge of the office of the National Association of Truck Sales Managers, pending the selection of a successor to H. D. Dabney, secretary. Dabney joined the organization last June, and his resignation will become effective March 15. He said he was not ready to announce future connection. A committee from the association now is in communication with several applicants for the position, and announcement of an appointment is expected shortly. Hilton, who is one of the best known members of the association, will spend a month or two in the local office inducting the new secretary before assuming other duties which he now has in mind.

W. J. Corr has been elected secretary and treasurer of the Maibohm Motors Co., Sandusky, Ohio, succeeding I. O. Bormann, resigned. Corr has been director of purchases for the Maibohm company for the past year and is widely known in the automotive industry. He was with the General Motors for the first two years following its organization, doing purchasing, cost and systematizing work at the Northway, Cadillac and Oakland plants. For the following two years he was director of purchases of the Apperson Brothers Automobile Co., then for two years director of purchases of the Falls Motors Corp. For nearly three years prior to joining the Maibohm organization he was purchasing agent for the Detroit plant of the Aluminum Castings Co.

Fred R. Wilhelmy, for many years with the Standard Parts Co. of Cleveland and its predecessor, the Standard Welding Co., in the financial and credit end of the business, has announced his resignation from that company, effective Feb. 15. Wilhelmy has always been active in get-together affairs of the trade, particularly where credit men were concerned, and is well known throughout the industry. His future plans have not been divulged.

K. T. Keller has been appointed manager of manufacturing of the Chevrolet Motor Co., succeeding F. W. Hohensee, who resigned to join the new Durant Motors organization. Keller has been in the General Motors organization since 1911, having served as superintendent at the Northway Motor & Mfg. Co., general master mechanic at the Buick Motor Co. and as a member of the general operations staff at the corporation offices in Detroit.

L. Grant Hamilton has just joined the staff of the Akron Advertising Agency, Akron. Hamilton, since the war, has been in active charge of the advertising of the Federal Motor Truck Co. Prior to the war, Hamilton was with the Campbell-Ewald Agency. He also served as advertising manager of the Regal Motor Car Co. and was a member of the advertising and sales promotion departments of Studebaker.

T. B. Blakiston has succeeded J. H. Quackenbush as general sales manager of the American Hammered Piston Ring Co., of Baltimore. Blakiston was formerly sales manager for the southeast district. S. A. Barclay was appointed to succeed Blakiston in this territory. A. N. Merrifield has been placed in charge of the western and Chicago sales districts, replacing D. T. Preyer.

B. F. McDonald, former works manager and lately general superintendent of the Moline Plow Co., has joined the Rock Island Plow Co., as factory manager. T. B. Fuller has succeeded him as works manager in the Moline Plow and A. C. Blair has been named general superintendent of that organization.

Roy M. Hood, purchasing agent for the Maxwell Motor Co., has left that organization and has been succeeded by A. C. Downey, formerly of the Willys-Overland staff at Toledo. Hood said he had several plans under consideration, but would not be ready to announce them for several days.

A. J. Riggs, of Racine, Wis., has been appointed general sales manager of the E. L. M. Tire & Rubber Co., of Racine, a new $200,000 corporation organized a few months ago to manufacture tires, tubes, mechanical rubber goods, etc., using as a plant nucleus the E-Z Rubber Heel Co. factory in that city.

M. F. Emrich, formerly vice-president and general manager of the Campbell Paint & Varnish Co. of St. Louis, a subsidiary of the Glidden Co., has recently been appointed general sales manager of the industrial division of the Glidden Co., with headquarters at Cleveland.

R. M. Guyer, formerly with the Dort Motor Co., has been made general manager of the Miller Auto Top & Body Co., of Caro, Mich. The following officers have been elected: President, George Van Tine; vice-president, P. A. Miller; secretary-treasurer, M. G. Atwood.

Guy C. Core, who has been advertising manager for the Jackson Motors Corp. for about a year, has resigned from that organization. Core has announced no future connection, and no appointment has been made to the vacancy in the Jackson office.

Earl L. Woods has been elected a director and vice-president of the Horse-Shoe Rubber Co., St. Louis and Kansas City, and will assume charge of the Kansas City territory. Woods was formerly sales manager for the J. I. Case Plow Co.

Edmund Otto, formerly secretary of the Hardware & Supply Co., has joined N. B. Payne & Co., New York, and will be connected with the department handling portable conveyors, coal elevators and other machinery.

D. H. Roberts, sales manager of the Latex Tire & Rubber Co., Fond du Lac, Wis., has been promoted to the post of general manager, in charge of operation, production, as well as sales and advertising.

Bob Crowthers has resigned his position with the Gary Motor Truck Co. and has joined Master Trucks, Inc., Chicago, in the capacity of advertising manager and assistant sales manager.

C. M. Eason, vice-president in charge of sales for the Hyatt Roller Bearing Co. resigned, effective Feb. 1. Ben G. Koether has succeeded Eason in charge of sales at the Hyatt factory.

R. C. Huddle has been appointed purchasing agent of the O. Armleder Co., Cincinnati, succeeding W. R. Hill, resigned.

W. J. O'NEIL DIES

AKRON, Feb. 14—William J. O'Neil, founder and president of the O'Neil Rubber Co., of Akron died suddenly of apoplexy, Thursday, while en route to his office. Mr. O'Neil was riding in the machine of A. H. Palmer and suddenly slumped forward, life being extinct before Mr. Palmer could summon aid.

Mr. O'Neil resigned from the B. F. Goodrich Co., eleven years ago to establish the company.

INDUSTRIAL NOTES

Palmer Tire Corp., Poughkeepsie, N. Y., has discontinued rebuilding tires and will build an addition to the factory for the manufacture of 30 x 3½ tires and tubes exclusively. The new product will be known as the Henry tire and tube. C. J. Davis, Akron, has been engaged to assume charge of manufacturing. A New York office will be opened at 5 Columbus Circle.

Caddenhead Auto Rim Co. has begun construction of its $100,000 plant at Tarrant City, Ala., where automobile rims and steel products will be manufactured, the daily capacity of the plant to be 3000 rims. Initial production will be about 400 or 500 rims daily. The company is headed by J. T. Caddenhead, prominent in business circles in the Birmingham district.

Atlas Metal Stamping Co., Inc., has taken over the business of Isidor Blickman. Noah Wollman Amdur will be president under the new organization of the company, and Mr. Blickman, treasurer. The headquarters of the company have been moved from New York to Brooklyn.

Highway Motors Co., Defiance, Ohio, will soon start the erection of a plant for the manufacture of tractors and truck motors. Charles H. Kettering of Dayton is president of the company, which has been making passenger cars exclusively.

Acme Wire Co., New Haven, Conn., has opened a Chicago office in charge of H. B. Bassett. The company also maintains branch offices at Cleveland, in charge of J. T. Crippen, and in New York, in charge of H. S. Glasby.

American Tire Fabric Co. closed operations Saturday. How long it will continue the officials here are unable to say, but they believe it will be for two weeks at least. About 300 hands are employed at the mills.

Dodge Mfg. Co. has taken over the Burnoil Engine Co. of South Bend, Ind., and sales of this product will be handled by the Oil Engine Division of the Dodge Sales & Engineering Co., Mishawaka, Ind.

O. Armleder Co. has opened a branch to serve the New York district at Third Avenue and Butler Street, Brooklyn. John S. Hyatt will be manager and A. W. Christopher sales manager.

Hoosier Auto Parts Co. has changed its name to the Hoosier Clutch Co. The business of the company will be continued at Muncie, Ind.

Kroyer Motors Co., Stockton, Cal., has awarded contracts for a factory unit in which will be manufactured the Wizard 4-pull tractor.

CLIMAX RUBBER MOVES PLANT

COLUMBUS, Feb. 14—The annual stockholders' meeting of the Climax Rubber Co., held at the home office here approved plans as submitted by officials. The company recently sold its Huntington, W. Va., plant and secured the plant of the K. & W. Rubber Co., at Delaware. Ohio, to which the machinery and equipment from the Huntington plant were removed. The Delaware plant has now become the main plant. Irving S. Hoffman was elected president; Herman A. Longshore, vice-president; Clyde B. Turner, secretary and treasurer, and E. W. Pavey, sales manager.

Calendar

SHOWS

Feb. 19-26—San Francisco, Fifth Annual Pacific Automobile Show, Exposition Auditorium, George Mahlgreen, Mgr.

Feb. 21-26—Louisville, Annual Automobile Show, Louisville Automobile Dealers Ass'n, First Regiment Armory, C. L. Alderson, Secy'.

Feb. 21-26—Salt Lake City, Annual Automobile Show. intermountain Automotive Trades Ass'n, W. D. Rishal, Mgr.

Feb. 26-Mar. 5—Buffalo, Annual Automobile Show, Buffalo Automobile Dealers Ass'n, 74th Regiment Armory, C. C. Proctor, Mgr.

Mar. 2-10—Des Moines, Annual Automobile Show, Coliseum, C. G. Van Vliet, Mgr.

Mar. 5-12—Atlanta, Annual Automobile Show, Atlanta Automobile Dealers' Ass'n, Auditorium, Virgil Shepard, Mgr.

Mar. 5-12—Brooklyn, Annual Automobile Show, Brooklyn Motor Vehicle Dealers' Ass'n, 23d Regiment Armory, George C. Lewis, chairman.

Mar. 5-12—Pittsburgh, Annual Automobile Show, Automotive Ass'n, Inc., Motor Square Garden, J. J. Bell, Mgr.

Mar. 5-12—Atlantic City, Annual Automobile Show, Automobile Trade Association of Atlantic City, Million Dollar Pier, A. H. Generatzky, Mgr.

Mar. 7-12—Syracuse, N. Y., Annual Automobile Show, Syracuse Automobile Dealers Ass'n, Armory, Howard H. Smith, Mgr.

Mar. 7-12—Indianapolis, Annual Automobile Show, Indianapolis Automotive Trade Ass'n, Automobile Bldg., State Fair Grounds, John Orman, Mgr.

Mar. 7-12—Nashville, Annual Automobile Show, Nashville Automobile Trade Ass'n, Page Bldg.

Mar. 12-19—Boston, Annual Automobile Show, Mechanics Bldg. and South Armory.

Mar. 14-19—Omaha, Annual Automobile Show, Omaha Automobile Trade Ass'n, Inc., Omaha Auditorium, C. G. Powell, Mgr.

Mar. 14-19—Washington, Annual Automobile Show, Washington Automobile Dealers' Ass'n, Rudolph Jose, Chmn.

Mar. 19-26—Detroit, Annual Automobile Show, Detroit Automobile Dealers' Ass'n, Morgan-Wright Building.

April 3-9—Denver, Annual Automobile Show, Auditorium.

April 4-9—Seattle, Annual Automobile Show, Seattle Motor Car Dealers' Ass'n, Arena Hippodrome.

April— Chattanooga, Tenn., Spring Automobile Show, Chattanooga Automotive Trade Ass'n, Sunday Tabernacle, C. A. Noone, sec'y.

FOREIGN SHOWS

Mar. 23-28—Witwatersrand Agricultural Show including machinery and motors sections.

April, 1921—Sofia, Bulgaria, Tractor Trials, under the Bulgarian Ministry of Agriculture.

May 28-June 8—International Automobile Exhibition, Basle, Switzerland.

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

October—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

CONVENTIONS

May 4-7 — Cleveland, National Foreign Trade Council.

Oct. 12-14, 1921—Chicago, Twenty-Eighth Annual Convention National Implement & Vehicle Ass'n.

Mexico City Exhibit to Start April 10

NEW YORK, Feb. 14—The automobile show which will be held in Mexico City will be opened on April 10 and continue for fifteen days. The show was originally scheduled to be held in March, and automotive manufacturers have been at some difficulty to ascertain the exact time of the exhibition. However, according to advices just received, the time has now been definitely set.

Three of the main salons of the new National Theater will be devoted to the showing, and the expectation was expressed that a majority of the 42 American cars represented in Mexico would be on display. The National Theater is described as a building which has cost $20,000,000 and which has been under construction for a number of years. It is now nearly completed and its use for the automobile show has been granted by the Government.

The show will be under the auspices of Señor Pascal Ortiz Rubio, Mexican Secretary of Communications. The show manager is Señor Gustavo Alana, Mexico City publisher and one of the officers of the Automobile Club.

Walker to Increase Engine Production

CLEVELAND, Feb. 14—Announcement was made at the annual meeting of stockholders of the Walker Motor Co. in this city yesterday that production is running from 10 to 15 engines a day now and that by March 1 it is expected production will have been doubled. Officials of the company are working on a program that calls for maximum production of 100 engines daily, and they expect to attain their goal later in the present year. At present the Grant Motor Co. is taking the bulk of the Walker factory output.

The stockholders yesterday elected as directors H. A. Tremaine, F. H. Blackburn, D. A. Shaw, Ben F. Hopkins, Robert L. Gale and George Salzman. Tremain and Blackburn, of the National Electric Lamp Co., are new directors. Officers will be elected in two weeks.

Purchasing Agents Meet to Devise Fuel Contract

PITTSBURGH, Feb. 18—Members of the fuel committee of the National Association of Purchasing Agents are meeting at the William Penn Hotel today to discuss a fair, equitable and inviolate form of contract governing the purchase and delivery of coal. The meeting was called by President W. L. Dodge. Ernest H. Hawkins of the E. I. duPont de Nemours Co. is chairman.

It is the purpose of the fuel committee to reach some form of contract which may be standardized, and at a later meeting the Advisory Council will meet with representative coal operators, distributers and purchasers to secure their advice and co-operation.

KELSEY ELECTS OFFICERS

NEWARK, N. J., Feb. 11—At the annual stockholders meeting of the Kelsey Motor Co. the following officers and directors were elected: Ernest B. Slade, president; C. W. Kelsey, vice-president; Thomas J. Stewart, treasurer; F. D. Dorman, secretary and assistant treasurer. Directors, E. J. Churchill, A. E. Jennings, John R. Thomas, Charles W. Hoyt, Charles Abbott, E. I. R. Cadmus, and L. S. Tyler.

ERNEST H. FULLER DIES

SYRACUSE, Feb. 14—Ernest H. Fuller, treasurer of the Automotive Service Association of Syracuse, died here after an illness lasting six weeks. John H. Sickeninger has been elected to fill the vacancy.

Belgium to Again Add to Import Tax on Cars

PARIS, Feb. 14—The Belgian Government proposes a further increase in the import duties on automobiles which were trebled last June. Importers representing large American interests are fighting the proposal, but Belgian manufacturers insist on protection.

The Peugeot Automobile Co. has no intention of using its own capital for the erection of a factory in the United States, but it is negotiating with an American group for the sale of a license to construct its cars. The Americans have not yet obtained the necessary capital and the plan is in abeyance.

Pennsylvania Rubber Re-elects Officers

JEANNETTE, PA., Feb. 14—At the annual meeting of the stockholders of the Pennsylvania Rubber Co. the following directors were elected for the ensuing year: Herbert DuPuy, Charles M. DuPuy, Seneca G. Lewis, George W. Daum, and A. H. Price.

The directors subsequently re-elected the following officers: Herbert DuPuy, chairman of the board; Charles M. DuPuy, president; Seneca G. Lewis, vice-president and general manager; George W. Daum, assistant general manager; A. H. Price, treasurer; James Q. Goudie, general sales director; George W. Shiveley, secretary; C. G. Morrill, assistant treasurer, and H. H. Salmon, purchasing agent.

PARTS MAKERS HEAR FRITZ

CHICAGO, Feb. 11—The Chicago Association of Automotive Equipment Manufacturers is making a drive for increased membership. At the present time there are 50 members enrolled. At the last meeting of the association an address was made by George Fritz.